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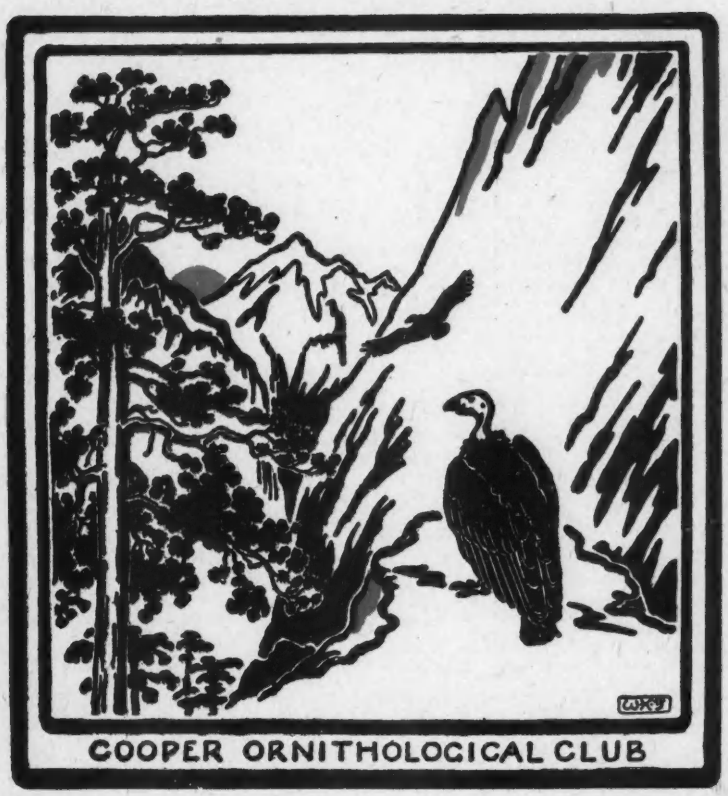
THE CONDOR

A Magazine of Western Ornithology

Volume XXXV May-June, 1933 Number 3



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Issued May 15, 1933

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THE CONDOR

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VOLUME XXXV | MAY-JUNE, 1933 | NUMBER 3

AN EXPERIMENT UPON A ROOSTING COLONY OF BLACK-CROWNED NIGHT HERONS

WITH THREE ILLUSTRATIONS

By E. LOWELL SUMNER, JR.

HISTORY OF THE COLONY

In the year 1898 the eastern end of the island of Alameda, in Alameda County, California, presented a primitive appearance which was in marked contrast to its present urban aspect. The city of Alameda, which now occupies practically the entire island and boasts a population of 35000 persons (census of 1930) was in those days represented by less than half that number, while most of the surrounding land was given over to extensive marshes and to grassy fields dotted with scattered stands of live oak trees. The marshes had not yet been drained, and they not only furnished a limitless hunting ground for the herons of the vicinity but were famous throughout the San Francisco Bay district as a resort for great numbers of waterfowl and shore-birds (Welch, 1931, p. 256). The open fields also had as yet suffered no disturbance, other than that resulting from the pasturage of a few cows; while the live oaks, which later were to be obliterated by the rising city, still furnished nesting sites for the herons, and even provided a last refuge for a pair of White-tailed Kites.

The first account of the Alameda colony of Black-crowned Night Herons (*Nycticorax nycticorax hoactli*) was published by Cohen (1900) after the birds had nested for two successive years in some tall cypress trees on his property. According to Cohen's statement no herons had nested on the island of Alameda during the years immediately preceding 1898, although evidence in the shape of several old nests indicated that prior to 1883 a colony of the birds had nested in the oaks. In any event the herons had regularly used the trees of the region for roosting throughout the entire period, and for that matter, as far back as any one can remember.

Included in this early record of the heron colony we find a lively description of the behavior of the birds, in which considerable emphasis is placed upon the noise which they made during the nesting season. The author of the account was a collector of natural history specimens and took an occasional set of eggs from the birds during the years that followed; however, these activities did not prevent the colony from increasing steadily in size and extent.

Mr. Donald A. Cohen, now living at Hayward, California, has very kindly supplied from his notes on the birds of Alameda much of the information given here regarding early conditions in Alameda, as well as a number of facts in the history of the heron colony itself. I am indebted to him, as well, for the kite record cited above.

During the first few years after 1898 only five or six pairs of herons nested on the Cohen estate, with an additional pair or two in the acacia trees on Central Avenue a mile or so away, but the birds steadily increased in numbers until by 1920 there were nearly two hundred pairs. Not only did the original settlement prosper, but a new heron metropolis sprang up in the tall, densely foliaged cypresses in Lincoln Park, situated at the extreme east end of the island and only a few blocks from the Cohen place. During this lapse of time the city of Alameda had also undergone a considerable expansion, particularly after the earthquake of 1906, and as a result of this expansion the land around the Cohen tract had become filled in with houses.

In spite of the advance of civilization to the very borders of their habitat the tranquility of the herons continued unbroken for some years. With the exception of a few persons who resided close to the nesting trees of the birds and heard the nightly bedlam raised by the young during the early summer, it is doubtful if one passer-by out of a hundred was aware of the existence of the heron colonies. The secretiveness of Black-crowned Night Herons is due to the fact that they carry on most of their foraging after dusk and just before dawn, while during the hours of daylight they are accustomed to sit silent and motionless in the densest foliage available where they may be seen only with difficulty. More than one instance has been recorded of birds of this species roosting unnoticed and undisturbed in the very heart of a city (Gander, 1930; Soto, 1931); indeed, the environment as well as the attendant circumstances in one of these instances (Soto, *op. cit.*, p. 89) strikingly parallels that of the herons under discussion, even to the close proximity in both cases of a school playground with noisy children romping all day beneath the sleeping birds (fig. 18).

Perhaps during these years the heron colony derived some advantage, such as protection from natural enemies, by its proximity to civilization. At least we find that in constructing their nests the birds took advantage of many introduced trees such as acacia, eucalyptus and cypress; indeed, the cypresses were chosen in preference to the live oaks which represented the ancestral home of the species in Alameda. Mrs. G. Earle Kelly, to whom I am much indebted for other information concerning the history of the heronry, has recorded (1920, p. 159) that one of the birds of the Cohen estate was seen by her to break off a twig from an introduced locust tree and carry it away to its nest.

It is possible, on the other hand, that the Alameda heron colony increased in size as a result of an abandonment by many birds of the adjacent colonies on the mainland rather than from a natural increase in the original residents. This possibility seems all the more likely when we consider that the process of settlement and reclamation which has transformed most of the surrounding country into a region incapable of supporting bird life was at its height at the very time the Cohen heronry attained its maximum numbers.

In 1925 the Cohen estate was sold to a real estate agency and cut up into small lots. All the cypress trees and most of the oaks were chopped down, streets were laid out and paved, dwelling houses rose up in solid ranks, and the old order vanished (fig. 19). According to residents in the vicinity, most of the dispossessed birds joined their kindred in Lincoln Park; but even there misfortune followed them. There is one cypress in the park which is by far the largest and most densely foliaged of all, and it was natural that these characteristics should make it the most desirable for roosting purposes. Unfortunately a section of the park where this tree grew was devoted to a base-ball field, and the grandstand had been built directly beneath the

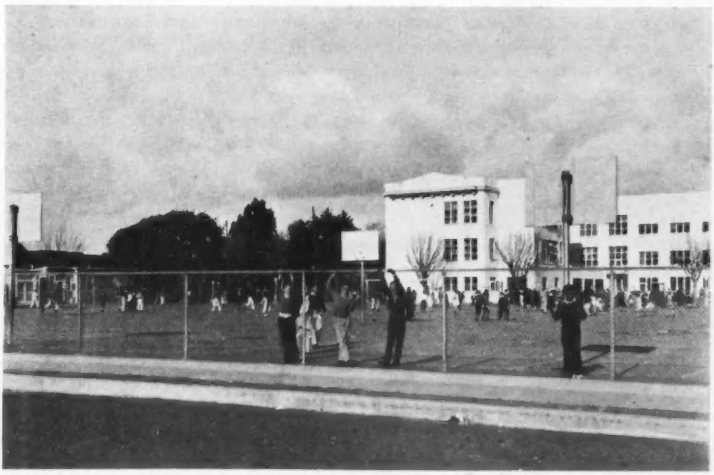

Fig. 18. California laurel tree which furnished a retreat for Black-crowned Night Herons is shown in the background as the large, dark mass at the left. The Lincoln School playground occupies the foreground.

Fig. 19. In these oaks a colony of Black-crowned Night Herons roosted for many years. View looking northeast from Gibbons Drive, Alameda, California.

shady canopy of this particular cypress. The use of the tree by herons had for a long time been a source of annoyance to those below, but when the numbers of roosting birds was suddenly increased by extensive reinforcements from the Cohen property, the situation became intolerable. A few of the birds were shot by the local police, but the problem was finally solved by members of the Lincoln Park force, who destroyed all of the nests in the tree and then placed in its topmost branches a large scare-crow, which still remains as a conspicuous object. According to workers on the park grounds, the herons have not returned to that particular cypress since the erection of the scare-crow, although I observed them in large numbers among the other trees in the park, where they are accustomed to nest undisturbed.

Not all of the birds which were forced out of their old home on the Cohen estate in 1925 repaired to Lincoln Park, however. About twenty of them sought refuge in the front yard of Mrs. Vira C. Scott, seven or eight blocks away, on Van Buren Street, and remained there until the autumn of 1931, when the experiment now to be described sent them off once more in search of new quarters.

DETAILS OF THE EXPERIMENT

In September, 1931, after having endured the presence of the herons in her front yard for about five years, at first with satisfaction but latterly with increasing disapproval, Mrs. Scott appealed to the California Division of Fish and Game to remove the birds on the ground that they constituted a nuisance. About a month previous to this a similar complaint had been made concerning a colony of Black-crowned Night Herons in the city of San Bruno, San Mateo County. Permission had been granted to the police department of that city to shoot the offending birds and their execution had been carried out. Following the publicity attendant upon the killing of the San Bruno herons, the suggestion had been made by Dr. Grinnell, of the Museum of Vertebrate Zoology, that the birds might have been induced to leave of their own accord by some method which took into account their natural habits. The Alameda heron situation afforded an opportunity to test this suggestion and, accordingly, when the complaint was received by the Division, the task of inducing the birds to move was assigned to the writer.

An investigation of Mrs. Scott's premises showed that there had been reason enough for complaint. The California laurel tree in which the birds roosted was a large and venerable specimen which cast its shadow over nearly half the house and dominated the small yard completely. Everywhere beneath the tree were the conspicuous white droppings of the birds; they covered the flagstones in the garden path, the wooden railings surrounding the flower garden, and even the front and back steps of the house.

Almost beneath the tree was a small gold fish pool, the inhabitants of which had suffered even more directly from the presence of the birds. Within the last few days thirty fish had disappeared, and I learned that in times past a pool belonging to the Hessemeyers, who lived next door, had also been plundered. On several mornings, at 5:30, Mr. Hessemeyer had discovered two herons fishing in his pool, and each time he had routed them by throwing potatoes. On one occasion, while retreating under fire of the potatoes, one of the birds got its wings entangled in a vine which was growing on the nearby fence, and barely managed to avoid capture. After this experience the herons ceased to visit the gold fish pool in question. The awkwardness displayed here seems to be characteristic of the species, for during the experiments to be described I found that when the birds were suddenly startled into flight it was not unusual for them to become momentarily tangled up among the branches of the California laurel tree.

The problem of removal offered several difficulties. Night herons apparently see as well in the day time as at night and, indeed, are not infrequently observed hunting in the full light of day. This independence of light conditions on the part of the birds was one of the chief obstacles in the solution of the problem. Had the herons done their sleeping at night, like the majority of birds, it would only have been necessary to shake the branches of their roosting tree or in some other way disturb them enough to send them blundering off into the darkness in search of another lodging. Most birds which sleep at night are unable to find their way about after dark well enough to permit a return to their roosting places. Under such circumstances two or three evenings devoted to the disturbance of the birds would probably have sufficed to fix upon them the habit of assembling at other quarters, and since the behavior of birds is, to a large extent, dominated by habit it would not have been long before the original roosting place would have been deserted altogether.

Kalmbach (1932, p. 70) has found that, "once a Starling has been driven from a roosting spot and *has located itself at some other point* there is no urge to return to its earlier roost unless driven from its new abode"—even after a lapse of three or four years during which the birds have regularly roosted close to the original roost location. In the case of the herons, however, the birds were far from being bewildered when driven from their retreats. Instead they would settle with protesting squawks in the tops of neighboring trees and there await my departure, necks craned in my direction and wings partly raised as they balanced awkardly among the slender top branches. Half an hour after my departure they would return to resume their interrupted slumbers. Unfortunately I did not at that time know of the successful employment of the scare-crow at Lincoln Park, and had taken it for granted that any such motionless object would soon cease to frighten the birds. It is probable that the wholesale destruction of nests, which accompanied the erection of the scare-crow, may have contributed to the effectiveness of the method. In the present instance there were no nests to destroy, however.

The possibility of throwing a large fishing net, such as a seine net, completely over the tree so as to prevent the birds from alighting in its branches was considered; but the size of the tree and the cramped quarters available for work rendered this plan impracticable. The use of pole traps was also out of the question, not only because of the attendant danger to the birds, but because such traps work efficiently only when baited or when placed upon prominent and convenient perches of the sort which furnish look-out posts for certain kinds of birds. In the case of Black-crowned Night Herons, however, the use of bait would result in failure because the birds feed upon shrimps, insects, salamanders and the like, which they are accustomed to seek on the ground or in water, not on the tops of elevated posts. Moreover, whether baited or not, the traps would be of little use, because of the circumstance that Black-crowned Night Herons are not attracted, as are hawks and owls, to isolated look-out perches, but instead are accustomed to plump themselves down into the thick foliage of a tree as soon as they arrive.

Dr. Jean M. Linsdale suggested that any strange object, such as a cluster of tin cans or a string of Japanese "wind-bells," might prove successful in frightening the birds away. As later events proved, however, the effectiveness of any disturbing contrivance depended more upon whether or not it operated without preliminary warning, and upon the degree of novelty which it presented to heron experience, than upon shape, size, or volume of sound emitted. A sudden light tapping upon the roosting-tree, for example, when performed at intervals far enough apart to prevent the birds from becoming accustomed to the sound, served to disperse the tenants, whereas a very loud noise, kept up all day long, would probably have been of no avail.

On September 22, I fastened four alarm clocks to the top of the bay tree by means of cords running through pulleys, which permitted the clocks to be lowered to the ground for re-setting and winding. From seven until nine in the morning the alarms were set to ring at half-hour intervals, and then shortly after nine I would arrive and set them to go off again at intervals of an hour until one o'clock. In the early part of the experiment I used to return once more and reset the clocks for the afternoon, but gave this up within a few days when it became certain that the birds did not return after the first two or three alarms in the morning.

Unfortunately the pressure of other duties always prevented me from arriving in time actually to see the effects of the alarm clocks upon the sleeping herons. Once I waited fifteen minutes until one of the clocks which I had just set should go off, but the birds, which had been disturbed into leaving at my winding the clock, stood in the tops of two nearby cypress trees, eyeing me with inquietude, and refused to come back. That the clocks did their work, however, is shown by the sudden decrease in the numbers of the birds. At my first visit there had been about nineteen herons present, and this represented the original quota according to the testimony of several residents. From the time when I first began to use the alarm clocks, however, I never found more than six herons in the tree.

By the third day all but the most obdurate herons had begun to form the habit of roosting elsewhere. It was seldom now that any of the birds ventured to come back after being driven away on my first morning visit, although as yet the old associations were too strong in the case of certain individuals to permit them to fly directly from their feeding grounds at dawn to the new roosting place; they still required to be pushed, so to speak, by the stimulus of fright. During the next seven days the number of herons which flapped out of the tree when I arrived in the morning fluctuated from one bird to six. Sometimes for a day or two there would be only one tenacious individual, but on the next day there might be three or four. From this it appeared as though one heron which refused to learn might be responsible for the occasional presence of the others, which had been lured back to their old quarters by its continued presence.

On October 2, the tenth day of the experiment, there were no herons in the tree all day, nor were there any to be seen during the six days which followed. On October 10, however, two birds were again present. From October 11 until October 20 the number of herons was never more than two, and on some days there was none at all, while those that did occasionally return had taken to roosting in a part of the tree which was farthest from the alarm clocks. There was no indication of any desire on the part of the birds which remained to leave permanently, however, and it was clear that they were losing their fear of the clocks.

On October 20, I found that the number of roosting herons had increased to three, thereby indicating that new methods of dispersal would have to be devised. The throwing of sticks into the tree top had always been a sure method of scattering the birds, but until now I had preferred to rely upon the clocks because they did not require my presence so often. Now, however, since the herons were in the habit of remaining absent for the rest of the day when once routed out, I substituted the throwing of a stick each morning for the winding of the clocks. From October 20 to December 1, I drove away the birds on twenty-two mornings. On some of my visits there were no herons present, but usually there were two or three, doubtless the same individuals each time. Toward the last the birds had begun to show an increasing toleration even for the commotion caused by the heavy stick which I kept for the purpose of throwing at them. Sometimes I would send it crashing into the branches

two or three times before the last birds would depart, and I found that the only sure way to get them to move was to strike the branches upon which they were actually perched.

During the next thirteen days, as a result of persecution more determined than heretofore, the number of roosting herons gradually diminished. Sometimes upon leaving, the birds would fly across the block to one of the scattered live oaks which remained as last mementos of the old Cohen estate, but usually they made straight for the cypresses in Lincoln Park, where the more adaptable members of the group had found refuge ten weeks earlier. Although none of the herons had taken alarm on the first day of the experiment until I had climbed seven feet up into the tree, the remaining birds had now become so timid as a result of persecution that they would leave the tree each day the moment I began to tiptoe under it.

In marked contrast to the timidity just mentioned was the behavior of one heron, which on several occasions was discovered roosting in plain sight in the top of a fig tree growing some thirty feet from the garden path. Earlier in the season when this tree was covered with leaves it had been a most secluded roosting spot, but now the leaves were all gone and the branches stood up bare and white against the sky, with the heron sitting full in the glare of the midday sun. Whether such eccentric behavior may have been dictated by habit is not certain; at least it was not due to a scarcity of other roosting sites, for even the most thoroughly pruned and cemented of the live oaks which survived in the neighborhood would have afforded more seclusion. This bird allowed persons to pass back and forth beneath it at a distance of twenty-five feet without apparent alarm; at least it never changed that hunched-up position which is characteristic of Black-crowned Night Herons in repose and which gives them such an aspect of dejection. Once, when I sent a small missile in the direction of the bird, it became somewhat aroused and took up a peculiar rigid position, with the head and body held nearly horizontally, which seems to be characteristic of these birds when they are alarmed (fig. 20). Perhaps this position represents an adaptation designed to enable the bird to spring into the air and escape in the least amount of time and with a maximum of efficiency; again, it may be occasioned, in part, by the efforts of the bird to see what is below it; probably both causes contribute.

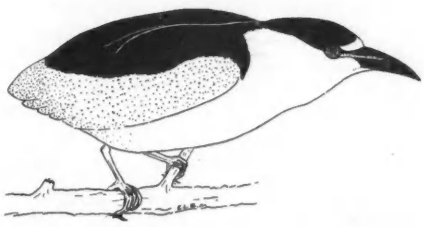

Fig. 20. DRAWING TO SHOW CHARACTERISTIC POSTURE ASSUMED BY A BLACK-CROWNED NIGHT HERON WHEN ALARMED.

After January 2, 1932, no herons roosted in the California laurel tree until the following March, when two or three of them returned once more. It seems likely that this was the same group of birds which offered so much resistance to the various attempts at driving them away which have just been described. From March until the present time (January 2, 1933) the number of herons in the roosting tree has at no time been more than three and has usually been represented by but a single individual; and since the presence of such a small number of birds has resulted in no inconvenience, they have been allowed to remain. The fact that the majority of the original flock of nineteen has never returned indicates that, as in the case of the

starlings cited above, when the birds have once become settled in a new roosting locality they do not return to the old site, provided they are not further disturbed.

SUMMARY

The Black-crowned Night Herons of Alameda have suffered an extensive reduction of their haunts during the past thirty-five years, due to the settlement and reclamation of the surrounding country.

In a portion of their last refuge some of the birds recently became such a nuisance that they had to be removed.

The problem of removal was rendered difficult by the fact that the birds were able to see to return to their roosts in the day-time after having been disturbed, thus retarding the formation of associations with a new roosting site. The majority of birds roost at night, do not possess the ability to return to their roosts when disturbed, and so would have offered less resistance to the process of education.

The removal of the herons was accomplished by means of a scare-crow in Lincoln Park, and in the case of the present experiment by the use of alarm clocks, the throwing of sticks, and by other agencies calculated to spare the lives of the birds.

When the length of time required by Black-crowned Night Herons to form new associations is considered, it appears that the birds are less intelligent than some other species, for example the starlings observed by Kalmbach.

In conclusion, it may be suggested that the methods here described indicate the possibility of "controlling" bird life, when this becomes necessary, by methods which do not involve extensive destruction of the birds.

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Museum of Vertebrate Zoology, Berkeley, California, January 15, 1933.

GEOGRAPHICAL DISTRIBUTION IN RELATION TO NUMBER OF EGGS

By CHARLES K. AVERILL

Not many generations ago it was thought that the various species of plants and animals had been placed each in the habitat to which it was best adapted. As the sciences of botany and zoology developed, however, it was seen that both plants and animals transported to far-off countries, by man's agency, often thrived so well in their new environment that they even became pests to the agriculturist; also it was seen that a large proportion of the weeds with which the farmer had to contend were not natives but came from abroad. We in America have learned to our sorrow that some birds could be introduced here and multiply so as to drive away native birds; and we are aware that periodically some insect from a far distant clime threatens our fruits and vegetables. Consequently, as we continue our studies in the distribution of plants and animals, we become aware that the absence of a species from a given fauna or flora does not necessarily mean that it is not fitted for the environment of that region; it may mean simply that it has not happened to reach the region. Continued research has convinced us also that in many cases a species having acquired a range may not have been able to hold it.

The main factors in distribution over wide areas, beside adaptation to environment, must be time, means of dispersal, and fecundity. In considering birds we can only speculate as to time; but means of dispersal which is power of flight, and fecundity which is measured by the number of eggs laid, are within our scope. A few examples of distribution in relation to power of flight may help to explain.

If we select in any of our families of North American birds, as for example the vireos, those species having the most extensive distribution, and compare them with those of limited distribution, we shall find longer wing in relation to tarsus, to accompany greater distribution. Thus, Red-eyed, Philadelphia, Warbling, Yellow-throated, and Solitary vireos all reach northward into British provinces and have a wing length of four times or more that of the tarsus, while White-eyed, Gray, Hutton, Stephens, Bell, Least, and Black-capped vireos, all of southerly or southwesterly distribution, have the wing only about three times the length of tarsus. The differences in wing length are apparent to the eye; it is not necessary to measure. In the Tyrant Flycatchers we may select the long-winged Olive-sided Flycatcher and Wood Pewee, with its western race, as those having the most extensive distribution, both north and south, and east and west. In the same way the most widely distributed among the genus *Dendroica* have the greatest length of wing. While this correlation is due largely to the elimination of the unfit in the long migrations the birds have to make each year to and from their summer homes, it will be noted that the longer winged species also have a greater extent of range east and west. It is hard to believe that these physical proportions are due to climate or environment. If we are to understand geographical distribution we must take into account the means of dispersal, and not rely too much on fitness for a particular environment.

Coming now to the main point, let us start with the passerine birds. In the following accounts the name of the species is given first, then a brief indication of its range, followed by the minimum and maximum number of eggs, separated by a dash. It will be convenient to ignore the subspecies and also to note the existence of representative species in the Old World. The numbers of eggs are taken from the works of Chapman, Coues, Davie, Ridgway, and "Birds of America" in "Nature Lovers Library."

Among passerine birds of North America the kinglets seem to have the largest number of eggs: Ruby-crowned Kinglet, North America at large, 5-9; Golden-crowned Kinglet, North America at large and representing the Golden-crowned Kinglet of Europe, 6-10. These figures are much in excess of the usual 3-4 and 4-5 or 6, of passerine birds.

The Brown Creeper, eggs 5-8, is a bird of wide distribution in both Old and New worlds, the American bird not being specifically distinct from the European.

The nuthatches and titmice are two families with eggs in excess of the average, 4-7, 5-6, 5-8 being common figures for the first, and 5-9, 5-8 for the second. Both these families are represented by the holarctic genera *Sitta*, *Parus*, and *Lophophanes* (as formerly constituted), of wide distribution, although no species is common to both Nearctic and Palearctic regions.

The Winter Wren is regarded as "the strict representative of the European Wren" to quote Coues. It ranges North America at large; eggs 5-8.

It will be noticed that the ranges of these birds just mentioned include the ranges of the great majority of our passerines whose eggs are less in number. We cannot then ascribe the greater fecundity to temperature or climatic conditions. There is an interesting correlation that may help to explain; the smaller bird lays the most eggs.

The kinglets are among the smallest of our passerine birds, and their eggs as shown by their measurements are the smallest outside the hummingbird family. Their nesting and feeding habits are not apparently different from those of many other small birds, such as warblers and vireos. The Brown Creeper, Winter Wren, nuthatches, and titmice will be recognized as pygmies among birds without quoting any figures. Among the grebes the 3-5 eggs of the Western Grebe measure 2.50 by 1.54 inches, the 4-8 or 6-9 of the Pied-billed Grebe only 1.72 x 1.17 inches. Taking the woodland owls, and omitting the ground-nesting species so that we may be comparing birds of similar habits and environment, we have Great Gray Owl 2-4 eggs, 2.16 x 1.71 inches; Great Horned Owl, 2-3 eggs, 2.20 x 1.80; Barred Owl, 2-4 eggs, 2.0 x 1.65. The smaller species much exceed these in number of eggs; Screech Owl, 4-6 eggs, 1.55 x 1.22; Long-eared Owl, 3-6 eggs, 1.65 x 1.30; Richardson Owl, 3-7 eggs, 1.35 x 1.14; Saw-whet Owl, 3-5 eggs, 1.19 x 1.00; Hawk Owl, 3-7 eggs, 1.50 x 1.23.

Why do the larger birds lay fewer eggs? It is not difficult to name one reason. The Barred Owl, for example, has 2-4 eggs, the Long-eared Owl 4-6. It appears at first thought that the Barred Owl, having fewer mouths to supply, has an easier task in feeding its young than the Long-eared, but this is not so; for, the eggs being similar in shape, their content is in ratio of the cube of a similar diameter. The egg of the Barred Owl is as already stated, 2.0 x 1.65, that of the Long-eared Owl, 1.65 x 1.30. Cubing either diameter and comparing we find the content of the larger egg to be nearly twice that of the smaller. As the chick fills up the egg in either case, if the eggs of the two birds were the same in number the Barred Owl would have nearly twice the bulk of young to feed—nearly twice the amount of tissue to nourish. In the same way if we compare the egg of a kinglet with a bird of similar habits and environment, a Blackpoll Warbler, for example, we find with an equal number of eggs the warbler would have nearly twice the bulk of young to feed. Moreover the young of the larger bird have to be fed for a longer time. To appreciate the labor of the adult birds it must be remembered that the young in the nest consume each day at least their weight in food, and that the adults also have to feed themselves.

We can apply this reasoning to birds of similar habits whether they belong to the same family or not; for instance, if the Loon had as many young to feed as a Western Grebe it would have more than twice the bulk to nourish; as it is the Loon has but two young. It is true the young of grebes and loons leave the nest soon after hatching, but they are attended and fed by the parents for some time. No doubt it takes time for the little ones to acquire the ability to take their food by diving. In "The Secrets of the Eagle," Gilbert and Brook, is a photograph of two adult Black-throated Divers each carrying a tiny fish in its beak to the young. In all these examples, if the smaller bird is busy in feeding its young, the larger bird, if the number of young were equal, would be overworked and the young undernourished. In some cases it may be that the larger bird can get a different kind of food and thus lighten its labor. A crow or a grackle, for example, can raise as many young as most passerine birds, much of its food being of a different nature.

Other examples of correlation of size and number of eggs are the Black Swift, of very large size for its family, and of very limited distribution in the western United States. It lays one egg, while the Vaux Swift and the Chimney Swift, very small in comparison, have 4-6 eggs. In the genus *Sula*, the gannet of the North Atlantic has one egg, while the much smaller booby, a tropical bird, has two. The three eiders breeding in the arctic regions, distinguished by their very large egg have 4-6 or 7 (Chapman), about half the number laid by the smaller ducks. Although there is a tendency for northern birds to lay more eggs than their representatives in the south, this may be overcome if the northern bird is much larger, as in the gannets and eiders. To the rule that the larger bird in a group of similar habits and environment lays fewer eggs, the Purple Martin is an exception, as it does not have fewer eggs than some of its smaller relatives.

There is a group of boreal birds that are holarctic, which may not have a greater number of eggs than most northern passerine birds, but certainly have less than the kinglets, wrens, titmice, creepers, and nuthatches. These are shore larks, pine grosbeaks, crossbills, redpolls, Snow Bunting, longspurs, Bohemian Waxwing, Northern Shrike and Titlark. But all of these are birds with good power of flight, as we may see in the field, or may surmise from the long, pointed form of wing possessed by all but the shrike and grosbeak. The means of dispersal, that is the power of flight, is superior to that of the tiny birds of the first group. To this list must be added the Bank Swallow, of Boreal and other zones, which has wide range in the Northern Hemisphere. The eggs are but 4-6, but the bird, like all its family, is a tireless flyer.

We now come to cases where the number of eggs is less than the normal. The Redstart of the Canadian, Transition, and Upper Austral zones in eastern North America has 4-5, the Painted Redstart in the same genus, mainly of Arizona and New Mexico, has but 3. In the genus *Pipilo*, the Oregon Towhee, ranging in the coast districts from southern British Columbia to California, has 4-5, the Towhee of the eastern United States and adjoining British Provinces, 4; but the Cañon Towhee of New Mexico and Arizona has 3, rarely 4, and the Abert Towhee of the southwestern United States, 2-4. The Brown Thrasher of eastern North America north to British Provinces and west to the Rocky Mountains, 4-5, but the Crissal Thrasher of limited southwestern distribution has not more than 3, and some other thrashers of that region have less than the Brown Thrasher. *Phainopepla nitens* of the western parts of the United States from Utah, Nevada and Colorado southward, 2-3, and *Pyrrhuloxia sinuata* of southwestern United States and Mexico, 3. Probably there is a similar deficiency in the number of eggs of the southwestern

orioles (*Icterus*) as compared with the more widely distributed Baltimore and Orchard orioles. So much for examples in the west and southwest. We now come to some in the south.

We have already noticed the extensive distribution of the Winter Wren. If we list the whole wren family we have the following: Carolina Wren, north to Nebraska and Connecticut, west to the Rio Grande Valley, 4-6; Bewick Wren, eastern United States, Nebraska to Pennsylvania on the north, and west to the Pacific Coast, 4-6; House Wren, United States across the continent, 6-8; Winter Wren, Canadian Zone across the continent and represented in the Old World, 5-7 or 8; Short-billed Marsh Wren, Transition and Upper Austral zones, west to Kansas, 6-8; Long-billed Marsh Wren, Transition and Austral zones across the continent, 5-9. In this family we note the limited ranges of the Carolina and Bewick wrens corresponding to their limited fecundity.

The Acadian Flycatcher of eastern North America, whose breeding range does not extend northerly beyond New York and Connecticut on the east and Nebraska on the west, has the most limited range of its genus, *Empidonax*. Its eggs are 2-3, the remaining species 3-4 or 4-5. The Boat-tailed Grackle lays fewer eggs than the Purple and Bronzed grackles.

Among woodpeckers the Red-cockaded of the Austroriparian Fauna has 2-5, while the widely distributed Downy and Hairy have 4-6, and the Flicker, breeding from the tree limit in Alaska south to Florida and Texas, is credited with 5-9.

Birds of limited distribution, but with more than the usual number of eggs are Prothonotary Warbler and Rough-winged Swallow; perhaps the peculiar choice of nesting site has something to do with this. The Bush-tits and Fan-tailed Wrens, being very small birds, keep to the rule of an excess of eggs, but are of limited distribution in the west and southwest. Although the species of *Lophophanes,* Tufted Tit and others with an excess of eggs, are in North America of limited distribution, the genus is Holarctic.

That birds of temperate zones usually lay more eggs than their representatives in the tropics, is noted by Chapman (Handbook, 1932, p. 83), giving among other examples the Sooty Tern, Bridled Tern, and Noddy, as compared with the Arctic, Roseate, and Common terns, the first three having one egg, the others usually 3. These are large birds compared with small; nevertheless the law has to be reckoned with. Without going into the tropics the same tendency of the northern birds to lay more eggs than their southern representatives has already been noted. The western and southwestern examples, redstarts, towhees, thrashers, phainopepla, and pyrrhuloxia, are probably of southern origin and can be included in the same category with southern birds.

There may be some unknown physiological factor, but it is plain that the southern bird is at a disadvantage in feeding its young, because in the breeding season there are more hours of daylight as we pass from tropic to temperate or arctic regions, the northern bird having more time for feeding. Some of our Alaskan birds even have the "midnight sun." If we remember that each chick has to have at least its own weight in food each day, we realize what an effort it is on the part of the old birds to supply this, and that bird life in the breeding season is indeed a struggle.

We may sum up the distribution of North American passerine birds in relation to the number of eggs laid, in a formula:

1. Maximum 3; invariably of limited distribution in the south, southwest or west; not differing especially in size from their representatives in the north and east.
2. Maximum 4 to 6 rarely 7; includes the great bulk of passerine birds, but

none are Holarctic except about ten genera of long-winged boreal or arctic birds, three species common to Alaska and the Old World, the aquatic Dipper (*Cinclus*), and the Bank Swallow.

3. Maximum 7 to 10; a group of very small woodland birds, Holarctic and of extensive distribution, although of feeble flight, chiefly members of the following groups: kinglets, wrens, creepers, nuthatches, and titmice; in addition, the Magpie of western North America, similar to the Old World Magpie. Birds with an excess of eggs but of limited distribution, in the west and southwest, are bush-tits and fan-tailed wrens.

It is true that each species must have a number of young suitable to maintaining its population; but this is true only to a limited extent. There can be no perfect adjustment. A bird in relation to its food is one of a chain; a thrush, for example, has some bird preying upon it, and in turn it preys upon some insect which in turn depends upon vegetable food. Periodical fluctuations in numbers in any one link, which observation shows are constantly taking place, cause fluctuations in others of the chain, at times imperiling the existence of the bird. Unless we realize the continual struggle and continual change in our bird life, much of which takes place so slowly that we are apt to overlook it, we shall not be able to form a good conception of what has taken place or of what is taking place.

Bridgeport, Connecticut, March 1, 1933.

INDIVIDUALITY AND TERRITORIALITY AS DISPLAYED IN WINTER BY THREE PASSERINE SPECIES

By GRACE TOMPKINS

During the winter of 1931-1932 I carried on a detailed study of the everyday behavior of four individuals of each of the following three species: Golden-crowned Sparrow (*Zonotrichia coronata*), Nuttall White-crowned Sparrow (*Zonotrichia leucophrys nuttalli*), and San Francisco Spotted Towhee (*Pipilo maculatus falcifer*). The individuals studied were wild birds captured by means of bird banding traps in the vicinity of the University of California, Berkeley, California, and these birds were placed in large observation cages (sparrow cage, 10 x 3 x 6 feet; towhee cage, 12 x 2½ x 9 feet) in my room at the Museum of Vertebrate Zoology, Life Sciences Building. The cages were furnished with numerous bushes and suspended branches for perches, and a floor of earth and leaf mold.

One species was studied at a time, the Golden-crown from September 25 to November 4, 1931, approximately six weeks; the White-crown from November 4 to December 12, about the same length of time; and the Towhee from January 28 to April 6, 1932, about ten weeks. My general method was to place one individual of a species, distinguished by a numbered metal government band and a colored celluloid band, into the cage; a week later to add a second; then the third, and finally the fourth bird, at weekly intervals. After the observations the birds were released. Their subsequent histories are being followed whenever possible. For further details concerning this study, see my manuscript, "Individual and Specific Differences in the Behavior of Birds," a Master's thesis on file in the University of California Library.

INTERRELATIONSHIPS OF INDIVIDUALS AND TERRITORIALITY

It might be supposed that outside of the breeding season members of any one of the species studied, either in the field or caged, would exist peaceably side by side, with no appreciable difference in the action of one bird toward another; but such proved not to be the case. Not only was there constant activity and dispute in the business of eating, drinking and resting, but the competition of the Golden-crown over a given bit of territory, that is, feeding or resting place, was of a very different sort and intensity from that of either the White-crown or the Spotted Towhee. Putting aside for the moment the question of individuality, I shall try to explain these differences in the interrelationships of the members of a species, and their importance in the territory of the species.

With the Golden-crown, a flocking bird, the relationships of the individuals were fluid, that is, first one bird and then another gained temporary control of a position or a morsel of food. Thus, when a strange food, such as a small bunch of grapes, was put in the cage, each bird gave the typical "curiosity" reaction—it slowly approached the food with neck craned and head cocked, and with little hesitating forward jerks of the body. But any bird might be first, and any other bird might follow and drive it away. Later the first bird often returned and forced off the bird who happened to be in possession. When the birds were especially hungry and seed had been scattered about the cage, all scratched busily for a time. Under such conditions two birds might remain in the same vicinity for a moment, both feeding, before one or the other gave way. I did not see the first birds put in; the last one was greeted mildly, with a peck or two, but soon took its place on equal footing with its fellows.

CHART SHOWING RELATIONS EXISTING AMONG INDIVIDUALS

Golden-crowned Sparrow			Nuttall White-crowned Sparrow			San Francisco Spotted Towhee		
Date 1931	Bird added	Relationship	Date 1931	Bird added	Relationship	Date 1932	Bird added	Relationship
Sept. 25	A and B (Put in cage the previous day)	A + B	Nov. 4	Red		Jan. 28	No. 1 ♂	
			Nov. 9	Green	Red >> Green	Feb. 4	No. 2 ♂	No. 1 >>> No. 2
			Nov. 13		Red > Green	Feb. 16	No. 3 ♀	No. 1 >> No. 2 >>> No. 3
			Nov. 16		Green > Red	Feb. 29	No. 4 ♀	No. 1 >> No. 2 >> No. 3 >>> No. 4
			Nov. 19	Pink	Green >> Red >>> Pink	Mar. 15		No. 1 >> No. 2 >> No. 3 >> No. 4
Sept. 30	C (Put in cage the previous day)	A + B + C		No. 4 (Put in 1 hour after Pink)	Green >> Red >>> Pink and Green > No. 4			
Oct. 2		A = (?) B = C	Nov. 20		No. 4 > Green >> Red >> Pink			
Oct. 11	D	A = (?) B = C, but A B > D C	Nov. 24		No. 4 >> Green >> Red >> Pink			
			Dec. 2		No. 4 >> Green >> Red > Pink			
			Dec. 11		No. 4 >> Green >> Red >> Pink but Pink >> No. 4			
Oct. 15		A = B = C = D						
Oct. 27	(C escapes)	A = B = D						
Nov. 4		A = B = D						

Meaning of symbols indicating relationships are as follows: +, birds paid no attention to one another; =, supersedence; >, incomplete dominance; >>, dominance; >>>, especially vigorous dominance.

Age, as indicated by the colors of the crowns, seemed to have no influence in the relationship. None of the birds had had previous experience with banding traps. All were of approximately the same size. Sex was indistinguishable. The birds occasionally rested in proximity to each other, but otherwise never moved in concerted action except under the stimulus of sudden movement or loud noise near the cage, when all fluttered against the wire, or except when, as noted above, all scratched busily.

This fluid relationship of the Golden-crown, in which any approaching bird could successfully usurp the position of any possessing bird, and in which all lived together fairly peaceably, I have called for convenience *supersedence*. (See accompanying table.)

With the White-crown and Spotted Towhee, a different relationship held, which I have described by the word *dominance*. A dominant bird, in my meaning, was a bird which over a definite period of time could successfully usurp the position of another bird, while at the same time successfully defending its own position.

With the White-crown (like the Golden-crown a flocking bird), dominance held, but the degree of dominance of any one individual was subject to change. Thus while the first bird put in, for a time assumed dominance over the second, after several days, the second bird gradually refused to give way and itself successfully took the offensive. When strange food was put in, the birds gave the curiosity reaction of craned neck and raised crest, much as did the Golden-crowns, but the bird that was dominant at the time was usually first. All birds might feed for a while, then the bird that was dominant at the time would drive away the others. A new bird was attacked with more vigor and for a longer period of time than in the case of the Golden-crown. Age, as indicated by crowns, and previous experience with banding traps, seemed to have no influence on dominance. Sex was indistinguishable. All birds were approximately the same size. There was no concerted action except under stimulus of sudden movement, loud noise, or hunger.

With the Spotted Towhee, an ordinarily solitary bird, dominance held sway rigidly. The first bird put in, a male, maintained his authority over all the rest during the entire period of captivity. The second, also a male, was next in the point of dominance; the third, a female, next; and the fourth and last bird, a female, remained the "underdog," chased by the other three. It is an interesting point here that when No. 2 was put in, No. 1 attacked him vigorously, pecking him and pursuing him all over the cage, and only gradually diminishing the force of his attacks as the days passed. But when No. 3 was put in, No. 2 and not No. 1 immediately attacked the newcomer. No. 1 continued to maintain his authority, chasing any bird that got in his path, but did not go out of his way to pursue No. 3; while No. 2 used exactly the same tactics that had been used on himself. Similarly, when No. 4 was put in, No. 3, and not No. 2 or No. 1, gave chase and harried the newcomer without pause or provocation. In each case, almost a week passed before this special pursuit of a newcomer died down.

I could detect only one difference in the attitude of the sexes toward each other—only the two males actually fought. On several occasions early in the morning as the birds were actively feeding, No. 1 approached No. 2 in the typical attacking posture, crown flat and bill outthrust with a menacing jab, but No. 2, instead of giving way, assumed a defensive posture, his head held back close to his body, but his bill facing his rival. They stood thus a second, and then sprang into the air with a flurry of feathers. In an instant they had separated again, with No. 2 in retreat and No. 1 pursuing. No. 1 always seemed to be victor in these encounters.

When strange food was put in the cage, No. 1 was always first. He would approach unhurriedly with his eye on the food, and his crown feathers often slicked down and glossy so that his head looked snake-like. If the food was something much prized, such as wood beetles, all the birds might approach and eat for a moment, the two females daring the threatening gestures of the males until they were actually turned on and driven sharply away.

All birds were mature and of approximately the same size. Previous banding experience seemed to have no effect on dominance. The birds never acted in unison except under the stimulus of sudden movement, loud noise, or hunger.

CONCLUSIONS AS TO DOMINANCE AND TERRITORIAL POSSESSION

My observations on such a small number of birds of course warrant no dogmatic conclusions. However, I can suggest a theory to explain the relationships found in various species.

To summarize: in the Golden-crown Sparrow no one bird was continually dominant; supersedence was the general rule. With the White-crown, although dominance was shown, it was constantly changing. In the Spotted Towhee, dominance was distinct and rigid.

Here is a possible solution of the differences: The two species of sparrows studied are both flocking birds, the flocks feeding, each, over a large general area. In the large group comprising a flock, each individual sparrow is accustomed to having many others feeding close by (two to three feet apart is the usual feeding distance), and it is very unlikely that any one bird could enforce its will on the whole group. Instead, there must be a constant give and take, with many small conflicts over the possession of a given bit of territory or food, but seldom a quarrel which is actually injurious to the combatants, in the main the members of the groups associating together fairly peaceably. In the Golden-crown, this situation would be represented in its extreme form. In the small conflicts over any exact bit of foraging territory, any suddenly approaching bird would have the advantage of attack over the feeding possessor. Indeed, the very fact of quick movement near-by would probably encourage the instinct to retreat. At any rate, in the majority of cases, except when all the birds were very hungry or quarrelsome, the attacker would gain the right of way undisputed, the retreating bird merely hopping off a few feet and then foraging once more. It would not even be necessary to attack, often the mere approach of another bird would be the signal for a bird to hop on, the approximately two to three foot spacing being thus maintained. This certainly seems to hold true in large flocks in the field; and with my caged Golden-crowns it definitely did hold.

It may be noted that this principle of supersedence is the exact opposite of Howard's theory of territorial possession in the breeding season. In supersedence, the intruder has the right of way; in the other the possessor has the right of way. However, the two theories are perfectly compatible. In the breeding season flocking birds have separated out, preparatory to mating and nesting, and each male chooses a particular clump of bushes or tract of shrubs in which to reside, and defends his property vigorously from all male invaders. On the other hand, out of the breeding season, all—males and females—are foraging over the same general territory and none is claiming any particular location. In the latter case, it does not seem illogical that the rights of the individual should be reversed, so that no one bird has exclusive right to a bit of territory, but must give way and share with its fellows.

With the White-crown, the principle of supersedence does not hold with the same force. Here dominance is shown, the aggressiveness of the various birds of

a group differing, some individuals being able to usurp successfully the territory of others, while defending their own against attack. But dominance thus in evidence is not fixed. During my observations on the captive birds, no one White-crown was all-important throughout the period. The relationship was constantly changing, first one individual and then another gaining dominance over its fellows. As with the Golden-crown, the argument is always over a small section of forage or roosting ground, and once the dominant bird has acquired the territory, he is usually satisfied, feeding in his new possession and warning other birds away from the vicinity, by making little rushes at them, or demonstrating with head thrust out and a vigorous *cheep*.

Here, then, is a flocking bird which, while each individual is distinct at any given time in its degree of dominance over its fellows, nevertheless forages in the same general territory with a large number of its kind, and which attacks its neighbor only when it particularly desires, and is able to usurp, a bit of territory. The aggressiveness of the individuals differs, but no one bird is constantly dominant over the whole territory.

In these two species of flocking sparrows, the treatment of a newcomer of the same species differs to about the degree that the manifestation of dominance differs. With the Golden-crown, a strange bird is received peaceably. The rule seems to be that where there are many, and no bird master, there is room for one more. The newcomer may be pecked at a few times, probably because it is a strange object; but after a few hours, or a day or two at the most, it is accepted as one of the flock, taking the same part in the supersedence of feeding as the others.

In the White-crown, the newcomer has a more hostile reception. He is attacked almost at once and subjected to considerable persecution before he is finally accepted as one of the group. An aggressive individual, however, may soon defend itself and in a day or so may even be taking the initiative in attacks.

The Spotted Towhee is a solitary bird. In the field, except for the breeding season, only one towhee is ever found, save momentarily, in any particular location. Thus it is not hard to understand the actions of the captive towhees. The first bird put in the cage evidently took possession of the whole territory. The second bird that entered was immediately attacked and chased, not from any particular foraging ground, but from anywhere in the cage, with the obvious desire of forcing it to leave the vicinity entirely. The attacks were repeated, and often consisted of actual blows given the newcomer, who made little attempt to defend himself, but constantly fled from the bill of his persecutor. As the days passed, the force of these attacks diminished, but there was never any doubt as to which was dominant. The second bird never, throughout the observations, attacked the first, although occasionally, when attacked, he defended himself with some vigor. In the short fights that ensued, however, he eventually always retreated.

With the third bird, and the fourth, the condition was the same; obviously each newcomer was considered as an intruder to be at once driven away. There can be no doubt that in the field the first bird would have quickly forced away all of the others, just as each of them in turn would have driven away intruders on his own property.

Here, in the case of a solitary bird, we have Howard's theory of territorial possession by isolation in force the year round, except, of course, that both sexes have territorial possessions and a male drives away an invading female with exactly the same promptness that is used on an invading male. But the point is, the possessor is in the right, and enforces his rights without hesitation. There is no tolerance

of a newcomer, except, as in the cage, where necessity demands, and then the dominance of the possessor is rigorously enforced. Where the birds are spread out so that each has a sufficient territory for maintainance of its food supply, such a system is highly desirable. Invasion by another bird of the same species might mean a shortage of food and hence death for both. Thus the unsociability of the Spotted Towhee, his constant hostility toward all others of his kind (perhaps even his fierce appearing eye, which is red!), is explained. It is a necessary expedient in the struggle for existence and for the survival of the species.

INDIVIDUAL DIFFERENCES AMONG BIRDS

During my study of the three species of birds, I was much interested to note a number of individual differences both in appearance and behavior among the members of the same species. Of course there were also the strictly specific characteristics of plumage—the immature and mature crowns of the sparrows, and the more brilliant coloring of the male towhees. But there were besides these, evident small variations among individuals in the way the feathers were carried and in the posture of each bird. Thus individual D among the Golden-crowns had a habit, not shared by his fellows, of frequently raising his crest. No. 1 towhee, after he had been in the cage a week or so, unlike his fellows kept his body feathers almost constantly fluffed out, so that he looked like an animated puff ball. To see this round ball of feathers, with red eye glaring, fiercely enforce its dominance over the other birds was most impressive to the observer.

However, these individual variations in physical appearance could not be trusted to distinguish the birds *without* the aid of bands or some age or sex indication. This I proved to my combined satisfaction and sorrow with the first two Golden-crowns studied. They were put into the cage the same day and without any mark of identification. Both were young, immature crowned, and as like in appearance as two peas. From the first their behavior was very different. While I had them both under constant observation during any particular day I could distinguished them by some small thing such as a ruffled crown or drooped wing, which served readily enough. But unfortunately when I returned the next morning, as likely as not the drooped wing or ruffled crown would have disappeared, and instead one bird would have a misplaced tail feather. So although they still behaved very differently, how could I be certain which was which?

Consequently, I could never be sure of the exact relationship between these two birds (A and B), and hence the question mark on the chart. However, when all four birds chased each other indiscriminately away from a prized bit of cuttlebone, with the attacker in every case displacing the bird in possession and himself being displaced, the general trend of supersedence was plain enough.

Far more important, then, than any physical variation of the individuals, were the small differences in behavior. Such differences were apparent in every activity of the birds. Thus as regards eating, Golden-crowns A and B ate small wood beetles readily, but C and D refused to touch them. Among the towhees, No. 4 was the only one to touch berries of *Berberis darwinii*, yet *she* ate them with seemingly great relish.

In perching, Golden-crown D had a special lookout upon which it almost invariably rested and from which it drove the other birds if they happened to perch there. Moreover, it had a special route to this perch which it alone used.

As regards sleeping roosts, I could not make certain whether the sparrows used the same ones every night, but the towhees did. Towhee No. 1, the dominant bird, slept on the ground in one corner behind some thick brush. Every night he retreated

there and hollowed out the leaves with his breast, appearing suddenly, to drive away with a rush, any other bird that approached. No. 2 slept in the brush in the opposite corner. No. 3 retired early to the very tip of a dead tree, where she perched in plain sight. No. 4 roosted last, in the brush as near to No. 1's corner as No. 1 would let her.

Even in drinking, all the birds were not alike. When the water dish was freshly filled and put in the cage, a few drops often clung to the outside. Although no other bird was ever seen to notice them, White-crown No. 4 was often observed hopping up and pecking off these drops. When they had disappeared it drank as usual from the water in the pan.

As regards the inter-relationships of the birds of a species, their behavior seemed to a certain degree entirely the result of specific characteristics. Thus the supersedence of the Golden-crowns and the strict dominance order of the towhees was difficult to explain in any other manner. On the other hand, with the White-crowns, although a changing dominance apparently was the specific rule, just which bird was dominant seemed more of an individual matter. I will give one illustration.

On November 19, 1931, the last two White-crowns, Pink (marked by pink band) and No. 4, were trapped and brought to my room. At noon I banded Pink and put it into the observation cage. At first the bird lay limp in my hand. When I put it down it flew quickly to the far end of the cage and sat quietly in the bushes. For several moments the birds already in the cage, Red and Green, fed about without paying any attention to Pink. Then Green flew over, looked at Pink, and hopped away. Shortly after, Red flew up and perched near Pink. Red leaned over and with the head thrust out horizontally stared at the newcomer. Then suddenly Red pecked Pink sharply. Pink tumbled from the perch and fluttered to the ground to escape the attack. Red followed and pursued Pink about the cage. When Red desisted in order to eat, Pink hovered in the background, moving its body continuously in nervous jerks. Green in the meantime bothered neither Red or Pink unless they got in the way, in which case Green drove both from its path.

After an hour had passed, and the vigor of Red's attacks on Pink had somewhat diminished, I put the other new bird, No. 4, into the cage. No. 4 flew into the bushes and sat quietly. Both Red and Green hopped up and looked at No. 4, but did not attempt an attack. All three hopped off and began scratching. Pink still hovered in the background. After about ten minutes, No. 4 hopped down and fed with Red and Green. Red paid no attention to No. 4. Green approached until its bill touched that of No. 4. Neither bird would give way. Then Green thrust out its bill with a sharp peck. No. 4 uttered a *cheep* and kept its bill toward the attacker, but did give ground ever so slightly. Presently Green left No. 4 to scratch, and did not approach again. All the birds then fed.

By the next morning No. 4 had already gained dominance. No. 4 was the most active, the most alert, and the most pugnacious of the group. It usurped the food of the others at will except for Green, who occasionally disputed its authority. Pink remained for two weeks the underdog, forced to relinquish its position whenever it was desired by any of its companions. However, after the first day Red no longer singled Pink out for special persecution.

Even in the strict dominance of the towhees, some differences in behavior were evident. Although No. 4 towhee, a female, was fourth in dominance, she was much more rapid and alert in her reactions than No. 3. It was she, after No. 1, who rushed in to seize food when this was first put in the cage. Although chased by the other three, she always managed to get her full share.

INDIVIDUALITY IN BIRDS

The word *individuality* has been a source of much confusion in ornithology. It may be well to state at once that whenever I use the word to explain my own views I mean by it the expression, through behavior, of the slight innate physiological variations which occur in each individual of a species. This is true individuality.

Julian Huxley in his recent book on "Bird Watching and Bird Behaviour" (1930) points out that when we speak of the individuality of birds we are usually referring to the characteristics of the species and not to those of a single bird. Thus, when we say "a Robin does so and so," what we means is that "robins do so and so." This, of course, is not a surprising way of looking at things, considering the striking similarity in both physical appearance and behavior among the various members of any one species. However, Huxley himself later points out that true individual differences are present in birds, and are worthy of study.

Howard in his two books, "Territory in Bird Life" (1920) and "Introduction to the Study of Bird Behaviour" (1929), has this same bewildering double meaning in his use of the word individuality. He comments several times in both books on the distinct variations in behavior shown by members of a given species. Indeed, the second book is devoted entirely to the consideration of the behavior during the breeding season of particular pairs of birds of certain species; and the particular pairs are frequently contrasted with other pairs and individuals of the same species to show difference in behavior. Yet in his conclusions in "Territory in Bird Life," Howard makes the following statement (p. 269),

"In winter, then, the individual loses its individuality and is subordinated to the welfare of the community, whilst in spring it regains its individuality, and all its inherited instincts which then come into operation lead to its isolation from the flock."

I must confess when I read this statement I was puzzled as to just how much Howard did mean. Interpreting the word individuality solely from the point of view of the species, the statement is of course, an extremely significant one, explaining the life cycle of a flocking bird. But was this the only sense which Howard intended? Or was he implying also that with the waning of the reproductive impulse, the bird became more of an automaton—that with gregariousness the birds not only acted together but acted alike?

In case this additional meaning may have occurred to other readers and have been accepted by them, I would like to object to it here. It is true that in the field individual variations are usually detected only in the isolation period. because then a particular bird can be recognized and studied in the particular location which it inhabits. On the other hand, in the flock, variation seems to be submerged because the individual cannot be distinguished from the group. But when this difficulty is overcome by means of bands or other devices for identification, as in my observations, individual variations become as apparent in winter as during the height of the breeding season.

Undoubtedly the awakening of the sexual impulse in spring gives stimulus to new variations of the strictly individual sort. But the mere fact that the males separate out and begin fighting for their chosen territory is no proof of true individuality. For this attribute, as Howard himself has so convincingly proved, is a species, one almost might say an avian, characteristic. The individuality of any one bird in the breeding season is evidenced in the particular locality, out of many available localities, which he chooses; in the degree of vigor and alertness with which he discovers and drives out intruding males; in the special timbre of his voice; and in

the relative rapidity of his reaction to danger. In precisely the same way, the individuality of the same bird is indicated in winter by the degree of his quickness in obtaining food; in his relative ability to perceive a menace to the group; in his degree of vigor in defending himself according to the code of the group; and in his own special habits in regard to preference for perches.

With solitary birds the constant individuality of the bird can be most clearly seen. Such birds, after the successful fulfillment of the sexual impulse, nest building, and rearing of young, continue to remain in isolation and to defend their territories. Does a solitary bird immediately lose its individuality with the wane of the reproductive impulse? And has the young bird no individuality until the maturation of the sex organs?

The obvious answer would seem to be *no*.

In conclusion, then, I have used the term individuality in birds to mean the expression, through behavior, of slight innate physiological variations. This individuality I found to be manifested in two ways.

First, in the degree of reaction to the environment. Only rarely did individuals differ in kind of reaction; this is usually a constant specific characteristic. Under this heading come differences in pugnacity, in curiosity, in alertness.

Secondly, I found birds to differ individually in the formation of minor habits, one might almost say idiosyncracies, of behavior. Under this heading come such differences as choice of a special perch and food preferences.

All these differences are admittedly slight, but the fact that they definitely occur, that they are existent and definable, deserves to be heeded.

The author takes this opportunity to acknowledge assistance of various sorts in the course of her work on this problem from Prof. J. Grinnell, Mr. T. T. McCabe, Dr. A. H. Miller, Miss Mary M. Erickson, and Mr. E. L. Sumner, Jr.

866 North Chester Ave., Pasadena, California, October 7, 1932.

THE LECONTE THRASHERS OF THE SAN JOAQUIN

WITH ONE ILLUSTRATION

By JOSEPH GRINNELL

In February, 1932, the writer and his companion, Mr. Ward C. Russell, found themselves on a brief trip south along the west side of the southern (upper) San Joaquin Valley, in west-central California. In attempting to trace the local distribution of certain mammals and birds in that territory, enough new facts concerning the Leconte Thrasher (*Toxostoma lecontei*) came to our attention to appear to warrant this special contribution on that species.

In coming south from Mendota, Fresno County, we first encountered the Leconte Thrasher about seven miles due east of Coalinga, in the same county, near the highway leading toward Tulare and about where "Polvadero Gap" is marked on the Coalinga sheet, U. S. G. S. Here Mr. Russell obtained a breeding male and heard or saw at least three others, the morning of February 21; they were in a tract of large-sized atriplex, or kind of salt-bush, along an arroyo. This is about where Goldman (1908, p. 205) found the species in 1907. He met with it "from near Huron west to the Arroyo Los Gatos" and collected specimens, both adults and full-grown young, "June 29 to July 1." Human activities in the oil region immediately around Coalinga, including the arroyo from Los Gatos Creek, have doubtless resulted unfavorably to the birdlife native there; at any rate, we saw no promising thrasher ground close around Coalinga. Also our own rapid reconnoissance of the immediate vicinity of Huron, southwestern Fresno County, failed to show appropriate ground for Leconte Thrashers, although there was evidence that tracts of atriplex brush formerly existed there. But there remains much good-looking Leconte Thrasher country about midway between Coalinga and Huron, and our sample was probably from a fairly extensive population of the species there. This neighborhood, then, marks the northernmost limit of the range of the species west of the Sierra Nevada (see map, fig. 21).

In our zigzagging about over the Tulare Lake basin, now dry throughout, we found no trace of this species; nor, in proceeding farther south, did we see any favorable ground for it till we approached Lost Hills, Kern County. Here, our route again cut into the piedmont belt of atriplex, good-looking for the bird in question, which probably extends with some interruptions southeast from Coalinga along the entire west side of the Tulare Lake basin. But we did not stop to test the supposition, proceeding on to McKittrick. Here, within two miles northeast of this oil-town, in western Kern County, somewhat off the highway leading towards Bakersfield, we made a three-night "dry" camp, February 22 to 24, inclusive; and we obtained there the materials upon which most of the succeeding account is based.

This locality (two miles east and northeast of McKittrick) is at about 1000 feet altitude, on ground sloping gently down northeastwardly toward Buena Vista Slough, with low hills close by to the west and south. It is in the focus of the "rain-shadow" from the coast ranges—excessively dry and of desert aspect. Despite recent rains, copious for this place, much dry-surfaced bare ground was in sight. The new green stuff was restricted to the low places along "draws" or "washes", to shady sides of hills, to spots which had been worked by burrowing rodents, and to patches beneath and close about bushes. Even though it was yet February, with unusually heavy snow mantling the mountains to the east, south and west of us, the mid-day sunshine was powerfully warming.

The most conspicuous element in the perennial vegetation about us was a species of salt-bush. Fragments saved have been identified for me by Dr. H. F. Copeland, of the Herbarium, University of California, as *Atriplex polycarpa*. Xerophilous in extreme degree, my observation of it in the San Joaquin Valley shows this species of atriplex to be most characteristic of ground fairly well-drained when it does rain, thus ground usually with a decided slope and not notably alkaline. The bushes of

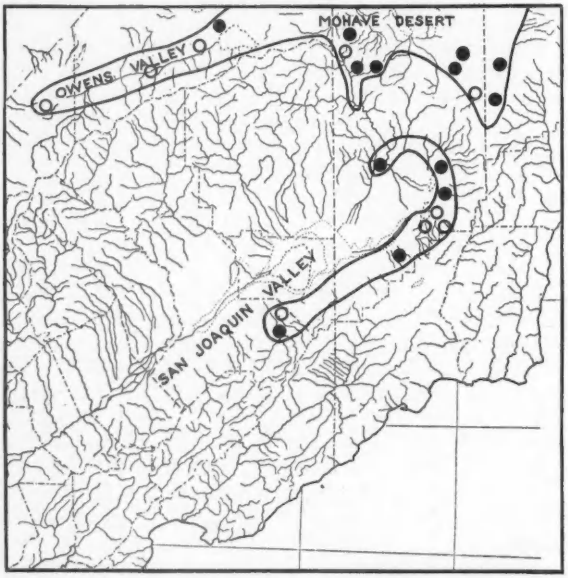

Fig. 21. STATIONS OF OCCURRENCE OF LECONTE THRASHER IN THE SAN JOAQUIN VALLEY AND ALONG THE WESTERN EDGE OF THE MOHAVE DESERT, CALIFORNIA; SOLID CIRCLES ARE STATIONS WHENCE SPECIMENS ARE AT HAND IN THE MUSEUM OF VERTEBRATE ZOOLOGY; OPEN CIRCLES ARE STATIONS OF RECORD OTHERWISE. ASSUMED GENERAL RANGE OUTLINED; BUT IT IS NOT TO BE INFERRED THAT THE SPECIES EXISTS CONTINUOUSLY OVER ALL THE INCLUDED AREA.

it grow small and far-scattered on exposed, high terrain; but in low places, in ravines and along gullies, washes, or arroyos the bushes grow eight or ten feet in diameter, and five feet or more high, and may crowd together here or there along a favorable draw to form a continuous thicket. It is the presence of this more luxuriant growth of atriplex that, together with much open ground between the scattering bushes nearby, and the general climatic conditions of high temperature and low humidity, appears to form the final requirement controlling the presence and relative numbers of the Leconte Thrashers in the San Joaquin Valley.

As we parked our truck at the side of a brush-lined gully on the evening of February 22, the first avian voice that reached our ears was that of a Leconte Thrasher. The next day, there proved to be a nest with three eggs, the birds of the pair sitting alternately, only 16 paces from the door of the tent we had set up

to work in. Other than brief snatches of song, morning and evening, and an occasional, clear, *quer-up* during the day, perhaps when the birds changed places, I heard nothing from them; I only saw them when I would go to the bush and shake it, when out would go the sitting bird on the opposite side, flying low over the ground and up the wash, partly running, and usually stopping a moment on the ground with tail held at a steep angle, before disappearing over a rise of ground. In a marvelously short time, only 15 minutes by one timing, provided I went into the tent out-of-sight, a bird would be back on the nest again. One of this pair was tailless, so the fact of about equal participation in the function of incubating as between the two sexes was easily established.

The day of February 24, beginning at dawn, was devoted by us to observation upon the thrashers. Singing of a nearby bird began at 6:10, when daylight had intensified to a point about balancing the brilliant moonlight of that dry atmosphere and when a red band had begun to glow along the eastern horizon. But this singing quickly ceased, and through the heat of the day we heard none. Perhaps earlier in the season, before incubation was generally under way, singing had been more persistent.

The first nest taken had been located by Mr. Russell the day before, a mile or so north of camp. We both approached the site, at 8:30 a. m.; a bird flushed when we were yet 30 paces from it, flying away from us low over the ground, was shot and proved to be a male. The nest bush was one of a row of large-sized atriplex bushes growing irregularly along the edges of a meandering gully in the bottom of a shallow draw. This bush was about 1250 millimeters high (to top of dense, leafy crown), with diameter a third greater. The nest rim proved to be 550 mm. beneath the crown of the bush and 670 mm. above the gently sloping ground directly beneath. The nest was not in the center of the bush, but was situated in the dense tangle of twigs about 700 mm. east of its axis, resting among the complexly branching stems which varied in slant from nearly horizontal to nearly vertical.

This nest, measured in place, showed an extreme diameter of 280 mm. and height of 190 mm. This, of course, pertained to the substructure, which consisted of straggling, dry twigs, long and varyingly slender, hardly distinguishable at the periphery from the surrounding dense leafless twiggery of the bush itself. How the bird could have managed the construction of this basal shell in such close quarters, so as to provide the proper space for the nest-proper, it was difficult for me to imagine. The inside diameter of the nest cup was 95 mm., depth from its solid rim, 60 mm. The entire inside cup was astonishingly firm, almost as if made of mud; it consisted of atriplex leaves and weathered bits of newspaper packed together so as to be of almost the firmness of pulp-board. Possibly the rains of the preceding month had had something to do with yielding this result; but even so, there was no resemblance at all to the porous, open-work, inner lining of a California Thrasher's nest—nothing for the young birds to clinch their toes and claws through. In this nest there was also a sharply distinguishable intermediate layer, of long fine grass stems and slender twigs; but none of this material reached the inner wall.

This first nest to be taken, with the male parent, contained three eggs in which incubation proved to be far advanced, so far, indeed, that I could only save one of the egg-shells intact. The second nest taken was the one at camp. It contained three eggs in each of which incubation later proved to be well along—about four days I should say. When I decided to collect this nest and appurtenances, at about 11 a. m., the bird which flushed from the bush when I shook its upper side with my foot was shot and proved to be the female. Twenty minutes later, after I had pur-

posely been away, down the wash, the other, male bird had come to the nest, was flushed, and was shot. Although, as previously stated, the two birds of this pair seemed to share about evenly in sitting upon the eggs, only the female showed the glandular-appearing condition of the ventral skin which develops at the time incubation is carried on. The male showed no trace of this; nor did the male shot with each of the three other nests taken show any incubatory patches. The male of nest number two had not a trace of tail feathers. The open follicles on the rim of the uropygium showed that the rectrices might have been lost rather recently. However that may have been, the bird was evidently attending in all respects closely to its breeding program.

This second nest was in an *Atriplex polycarpa* bush of moderately large mass, drooping over the cut bank of a gully which was extra deep at this point. The vertical height of this bank was 1850 millimeters, and it faced east. The nest was so hidden in the mass of branches drooping down over the face of this bank that its position could not be detected from any direction. There was an old nest 300 mm. from it, a little above its level, and toward the face of the bank. The occupied nest was 1 meter out from the bank, its rim 1080 mm. above the floor of the wash and about 1500 mm. below the uppermost part of the leafy crown of the containing bush. The extreme outside diameter of the twiggy substructure was 270 mm., its height, 210 mm. The inside diameter of the nest cup was 85 mm., its depth 60 mm. In general structure and materials it was quite like the first nest described—even to the incorporation of weathered newspaper along with the atriplex leaves into the hard inner wall.

The third nest found is recorded by Mr. Russell as situated in an atriplex bush growing some 20 feet apart from others on the low, sloping south side of a wash and within 6 feet of its bottom. The position of the nest in the bush was off-center, 650 mm. out from its axis and 650 mm. from the nearest outer limit of the foliage; it was 530 mm. above the ground (to rim) and 670 mm. beneath the crown of the bush. The nest rested upon and among branches which were nearly horizontal; its outside dimensions were: diameters, two ways at right angles, 340 and 260 mm.; depth 210 mm.; the inner cavity measured 95 mm. across at rim and 68 mm. deep. The twigs of the outer structure merged insensibly and intimately with the close-set surrounding twiggery of the bush proper. As with the other nests the inside of this one is firm and symmetrically moulded; the inner surface shows chiefly matted atriplex leaves, with here and there wadded bits of sheep's wool, bits of old sun-burnt cloth, fine rootlets, black hairs, and some fine gravel—the latter probably brought in on the birds' feet in wet weather. The collector hid near-by, and the bird which finally came, hesitatingly, over the ground toward the nest, uttering a low note, *pup*, at short intervals, was shot and proved to be a male. The three eggs in this nest were but slightly incubated.

The fourth nest taken contained four eggs in which incubation was well started. The sitting bird flushed when the observer had approached to within about four feet of it. He then hid and within five minutes the bird was seen returning, running quietly over the ground between and beneath the scattering bushes. It was shot and proved to be a male. This nest was in an atriplex bush of more open structure than the average, so that it was possible to see the outline of the nest from some little distance. The nest bush was one of a series closely lining a wash; it was 6 feet from the center of the bottom gully, which there had sloping, gravelly banks. The bush was on the north side of said gully, and the nest was situated in the south-facing, rather open, sunny portion of the bush—possibly of some significance when one considers

the time of the year. In this instance the nest was placed amid more nearly vertical stems of the bush; its rim was 890 millimeters above the ground and 1 meter below the extreme crown of the bush; two diameters of the gross substructure were 280 and 210 mm.; the concavity measured 100 mm. across at the rim and 55 mm. deep. In structure throughout, this nest is essentially the same as described for nests two and three; bits of wool and old rags are detectable in the lining.

Another nest, not taken, was evidently new and in final stage toward completion. Yet another nest found contained three young birds, as yet showing only natal down. A wait of three minutes brought no visible return of either parent bird. (Small young, in this instance, on February 24 meant, I think, completion of nest-building the last week of January.) The last four nests referred to, actually occupied or new, were found in a walk of approximately three miles in a semicircular course along washes. While concentrated thus for nesting along the washes where the largest atriplex bushes grew, we observed that the birds also traversed, apparently for forage purposes, the more open terrain at large, even where bushes were quite small and far-scattered.

With all these observations in mind, a topographic map in hand, and the surrounding landscape in immediate view we estimated the population of Leconte Thrashers in the favorable belt of territory lying two to six miles east of McKittrick at six (6) pairs of adult birds per square mile. If memory impressions can be given any weight at all, this is somewhat in excess of the number per square mile in parts of the Mohave and Colorado deserts where I have done field-work, even in the very favorable mesquite belt of Death Valley (see Grinnell, Proc. Calif. Acad. Sci., ser. 4, 13, 1923, p. 103).

To return to the subject of nests: Both Mr. Russell and myself found many old nests of the Leconte Thrasher. They are so durable in structure, and their envelopment in the dense branch-work of the long-lived atriplex bushes so protective, that they must last several years after the season of use. In one circuit that I made, I found by count fifteen (15) old nests in the same distance within which one pair of birds was encountered. These nests were in varying stages of disintegration, but always recognizable by even fragmentary remains from the nests of the few other birds that are known to breed in the same association. Whether more than one nest is built by a pair of thrashers in one year I do not definitely know, but if the first nesting of the season be successful (that is, the brood reared) I suspect only one. Several bushes of most favorable size and location had two nests in them; or there were four or five old nests in three or four closely adjacent bushes. Appropriateness of site had probably led the same pair or even successive pairs of birds to resort to the same restricted situation several successive years. These old nests varied in height above the ground from 375 to 600 millimeters, thus less than the average of the new, occupied nests; but this can be accounted for by their usual location off-center, amid supporting branch-work which is of more or less horizontal trend and which tends to flatten down as time passes and as the whole bush grows higher.

A consideration of these old nests helps build up the general picture already outlined of the Leconte Thrasher's special habitat requirements; namely, terrain grown sparsely to small bush-clumps, these clumps providing shelter from sun and enemies when needed, and in the loose litter about their bases sources of food to be sought in the thrasher's own peculiar method; and also, here and there, along the edges of gullies in the bottoms of draws, bushes of larger size and of dense, protecting and shading type of branching and foliage, which provide the essential type of breeding niche.

The eggs of the Leconte Thrasher preserved from the neighborhood of McKittrick measure, in millimeters, as follows. Set no. 1 (one egg out of 3): 26.9 x 19.1. Set no. 2: 27.3 x 19.3; 27.3 x 19.7; 27.6 x 19.7. Set no. 3: 28.2 x 20.2; 28.1 x 20.1; 28.2 x 20. 3. Set no. 4: 26.1 x 17.6; 25.2 x 18.5; 24.7 x 18.3; 25.4 x 18.3. Average of the 11 eggs: 26.8 x 19.2, thus decidedly smaller than eggs of the California Thrasher. Incidentally, these sets with their nests are now, respectively, numbers 2417—2420 in the egg collection of the Museum of Vertebrate Zoology.

In ground color the Leconte Thrasher eggs are close to Beryl Blue, perhaps verging toward Pale Turquoise Green—these terms as illustrated in Ridgway's "Color Standards" (1912). The three sets of 3 eggs were all dotted rather abundantly (concentration marked toward the larger ends) with varying shades and tints from Mars Brown (darkest) to Pale Purplish Vinaceous—the paler end of the series of tones probably due to the same pigment being buried to greater depths in the outer layers of the shell substance. In the set of 4 eggs, three of them are entirely immaculate; the fourth shows faintly a scattering of dots of Vinaceous-brown. As compared with a series of eggs of the California Thrasher, the Leconte Thrasher's eggs are not only smaller but they have on an average finer and decidedly sparser markings; also no egg of the 49 Californias at hand is entirely without markings, as are 3 out of the 11 Lecontes.

Now as to distributional considerations: I have reviewed all that has been published concerning the Leconte Thrasher; I have searched through the field notebooks in the Museum of Vertebrate Zoology; and I have examined the 88 specimens of the species at hand and taken into account the facts furnished by the data attached to each of these. It becomes clearly certain that the population of *Toxostoma lecontei* occupying portions of the San Joaquin Valley is completely cut off from the main range of the species, which covers the Mohave and Colorado deserts (see map, fig. 21). The barrier now operating to sequester this population would appear to be comprised in the mountains which encircle continuously the southeastern (upper) end of the San Joaquin Valley. However, it is not the factor of intervening altitude, *per se*, that operates; for the thrashers exist continuously, west from the edge of the Mohave Desert, over the Walker and Kelso passes (of altitude 5248 and 5300 feet, respectively) and down on the west side of the Sierran divide to the valley of the South Fork of the Kern River. Here the birds occur down to about 2500 feet, in the vicinity of Isabella; coextensively with them goes to about this limit westwardly a large number of other xerophilous, Lower Sonoran types of animals and plants. The terrain which they thus inhabit is dry and in summer hot, and these conditions are evidently permitted westward as far as they go by the north-south Greenhorn range of high mountains, which lie west of the Kern River opposite where it is joined by the South Fork of the Kern. The lofty Greenhorns cut off the moisture from the east-flowing air currents, and the dead-air pocket behind them doubtless has also to do with the heat accumulation in summer—despite the relatively high altitude of the South Fork Valley and the passes farther to the eastward. The Piute Mountains also cast their "rain-shadow" to the eastward, affecting similarly a portion of the main Sierran divide in the vicinity of Kelso Pass.

To the southwestward of the latitude of Isabella the Greenhorns fall away, their "rain-shadow" pinches out, and for a long interval down along the lower course of the Kern River, nearly to the low level of Bakersfield, the conditions are very different—Upper Sonoran vegetation and with every evidence of greater rainfall. It is this interval, then, wholly unsuited to the inherent requirements of the Leconte

Thrasher (because of the unfavorable nature of the flora, too low temperature and too high relative humidity), that constitutes the true sort of hiatus between the San Joaquin population of the thrashers and that of the Mohave Desert.

Since the separating belt of unfavorable conditions is narrowest in the Kern River segment of the mountains semicircling the head of the San Joaquin Valley, and in view of the fact that it is only in this segment that the thrashers at the present time exist over the divide into the San Joaquin Valley drainage, I think we can suppose most reasonably that it was along the Kern River route that the original San Joaquin stock travelled. With a general climatic "pulsation" toward the hot, dry extreme of conditions, the Upper Sonoran barrier would be weakened; there would be most likelihood at such a time that frontier breeding would extend farthest, and pioneering individuals get clear through the intervening territory until they should reach the Lower Sonoran and arid rim of the San Joaquin bed where successful and permanent establishment could quickly take place. Of course this same hypothesis could be invoked, it seems to me with good grounds, to account for the presence in the upper San Joaquin Valley of most other Lower Sonoran and xerophilous animals which we now find more or less firmly and extensively established there.

In the cases of some of the Lower Sonoran mammals of the San Joaquin Valley, we find that the isolation of their populations there at some more or less remote time has resulted in differentiation of characters to a degree easily recognizable in comparison with their relatives on the Mohave Desert. In the case of the Leconte Thrasher, I have examined closely the series of specimens available from the San Joaquin in comparison with series from the Mohave and Colorado deserts. As to general size and proportions of the birds, I can detect no differences; but as to general tone of coloration, I think there is a *tendency* shown in the San Joaquin birds toward darkness. The best evidence of this is afforded by two specimens in the personal collection of Dr. Alden H. Miller. Each is an old adult in which the annual molt is under way; one is from near Palmdale on the Mohave Desert, northern Los Angeles County, taken July 22; the other is from a point near the highway nine miles north of Grapevine, in the San Joaquin Valley, Kern County, taken August 3. Comparing only the new, unworn and unfaded feathers, the latter bird shows distinctly the darker, more leaden-hued tone of dorsal coloration. This is close to Mouse Gray (of Ridgway's "Color Standards," 1912) as compared with Drab in the other bird. The next darkest one of the whole series, however, is from Keeler, Inyo County, of date September 25.

Unfortunately, birds in perfectly fresh plumage are scarce in the available series; and sun and weather evidently plays hob with the pigments in a thrasher's feathers—the intrinsic tints are fugitive. Fading as the season advances beyond the regular molt time carries the color tones away from gray in the direction of a bleached-out, sandy tint; for example, an adult from near Buena Vista Lake, taken May 5, is of a dilute Clay Color. The very palest of the entire lot is a bird from Florence, Pinal County, Arizona, taken April 4. Yet a number of specimens from the San Joaquin Valley and from the transmontane range of the species, adults or young, season taken into account, cannot be definitely separated; the color differences that may exist are inappreciable to my eye, when I take individual variation and probably varying rate of fading into consideration. To repeat, there is only a faint average relative darkness of the San Joaquin population of thrashers—of possible significance from the bionomic viewpoint, as indicating result of its isolation there—but not sufficient for recognition nomenclaturally.

The following are the important published references to the occurrence of the Leconte Thrasher within the San Joaquin drainage basin, as bearing upon the subject matter of the foregoing account.

Fisher, N. Am. Fauna No. 7, May, 1893, p. 128 (south and west of Buena Vista Lake).
Anthony, Zoe, IV, October, 1893, p. 223 (Onyx).
Merriam, Auk, XII, January, 1895, pp. 58-59 (account of general distribution).
Goldman, Condor, X, September, 1908, p. 205 (Huron and westwardly).
Swarth, Condor, XIII, September, 1911, p. 161 (vicinity of Bakersfield and McKittrick).
Willett, Condor, XIX, July, 1917, p. 143 (vicinity of Buena Vista Lake and Maricopa, nesting).

Museum of Vertebrate Zoology, University of California, May 22, 1932.

FOSSIL BIRD REMAINS FROM THE EOCENE OF WYOMING

WITH ONE SET OF ILLUSTRATIONS

By ALEXANDER WETMORE

For a number of years the paleontological department of Princeton University has conducted explorations in the Eocene deposits of Wyoming, particularly in the Bighorn Basin. Through Professor William J. Sinclair the bird remains from these investigations have been placed in the writer's hands for study; a report on them is here given. Drawings illustrating this paper have been made by Mr. Sydney Prentice.

Avian fossils from the Eocene deposits of North America, with two exceptions, have been fragmentary and poorly preserved, and in most cases have been difficult of study. The species that have been described exhibit certain resemblances to living groups so that part have been placed in existing families, while two, *Diatryma* and *Gallinuloides,* have been made the types of peculiar families. Some have been described in living genera but generic allocation in these instances is considered doubtful.

The author may repeat here a statement he has made elsewhere that it is his opinion that the fossil birds of the Eocene, while resembling modern birds in general, in most instances differ considerably in structural detail. Though some have been placed in modern genera, such close relationship is doubtful, and it appears probable that with sufficient study most if not all Eocene species will be allocated in subfamilies and families other than those in existence today. In addition there are certain highly peculiar forms representative of an order no longer in existence, and others of similar status will in all probability be found as exploration of our Eocene fossil deposits continues.

Order GRUIFORMES

Superfamily GRUOIDEA

Family GERANOIDIDAE, fam. nov.

Geranoides, gen. nov.

Characters.—Those of the species described below.
Type.—*Geranoides jepseni,* new species.

Geranoides jepseni, gen. et sp. nov.

Characters.—Distal end of metatarsus somewhat like that of *Grus canadensis* [*Ardea canadensis* Linnaeus, Syst. Nat., ed. 10, vol. 1, 1758, p. 141], but with the second and fourth trochlea more nearly on the transverse plane of the third, projecting less posteriorly behind the axis of the shaft; second and fourth trochlea extended farther distally in relation to the third; intertrochlear spaces relatively wider; lower end of shaft more flattened.

Description.—Type, distal end of left metatarsus, Princeton University cat. no. 13257, from Grey Bull formation, Lower Eocene, South Elk Creek, Bighorn County, Wyoming, collected by G. L. Jepsen, August 29, 1928 (fig. 22, 1-3). Shaft long and relatively slender, much crushed and broken, but with a shallow groove indistinctly indicated in front, much flattened transversely at lower end; a distinctly impressed groove leading into an inferior foramen of good size; facet for articulation of first toe small but evident; supporting base for trochleae flattened, with curve formed by the three trochleae relatively flat and open; inner trochlea flattened from side to side, projecting behind line of shaft except at its attachment, its distal margin reaching slightly more than one-third the height of middle trochlea, its posterior margin projecting in a flattened plate (tip of this broken away); distal margin marked by a shallow groove with two excavations on outer face; inner margin deeply excavated; internal intertrochlear sulcus wider than ordinary, part of the separation being due, however, to crushing so that original width is not certain; middle trochlea projecting distally beyond level of other two, in lateral outline elliptically rounded, lateral faces

much excavated and entire free margin marked by a broad, strongly impressed groove; on posterior face trochlea narrowed decidedly before it merges with shaft; outer trochlea flattened, swung posteriorly back of line of middle trochlea, and extended distally nearly to level of distal margin of middle trochlea; inner face much exca-

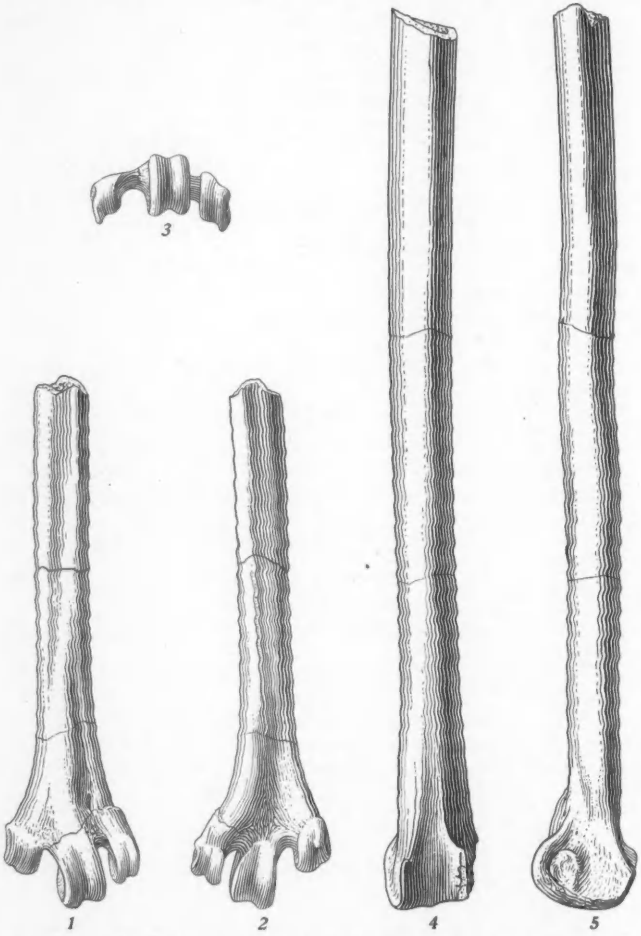

Fig. 22. *Geranoides jepseni*: *1*, *2*, *3*, THREE VIEWS OF THE TYPE METATARSUS; *4*, *5*, TWO VIEWS OF FRAGMENTARY TIBIO-TARSUS. NATURAL SIZE.

vated, with a smaller pit-like depression on outer face; external margin projecting in a narrow, flattened plate that rises distally to level of central portion, separated from this central portion by a slightly indicated groove; external intertrochlear sulcus relatively broad. Specimen dull brownish in color.

Measurements.—Greatest transverse breadth across trochleae, 21.7 mm.; smallest transverse breadth of shaft, 8.0 mm.

Remarks.—In addition to the broken metatarsus selected as the type there were found associated, in such a manner as would indicate that they were part of the same individual, several other bones including a left tibiotarsus with the head missing and considerable wear on the condyles, the poorly preserved head of a right tibiotarsus, part of the shaft of a metatarsus (possibly from the right side, although this is not certain), three phalanges, the end of a radius, and three fragments of uncertain affinity. All bear the same catalogue number, 13257, as the type.

Allocation of this fossil in the superfamily Gruoidea has come only after prolonged comparison. The type metatarsus differs in various details from that of any bird known to me. In its general form and in the relative positions of the trochleae it appears distinctly gruiform and more similar to the superfamily Gruoidea than to others included in the order. Its most peculiar feature is the width of the intertrochlear sulci, the trochleae being more widely separated than in any other bird that I have seen. There is a suggestion of this condition in *Diatryma steini*, but due to abrasion and crushing it is not certain that the lower end of the metatarsus in the type of *D. steini* is not considerably modified from its natural condition. As *Geranoides* is decidedly different from modern cranes it is placed in a separate family the Geranoididae.

The tibiotarsus (fig. 22, 4-5) is long and slender. The external condyle is more rounded on its anterior margin than in modern *Grus*, and the central tubercle on the anterior face external to the supratendinal bridge is lower and less developed. The internal condyle is missing except for its posterior portion. The other characters evident are gruine so far as they are present. The shaft in its smallest transverse diameter measures 9.3 mm., and the outer face of the external condyle is 15.4 mm. broad.

The other fragmentary bits and the phalanges offer no characters worthy of note.

Geranoides jepseni was apparently about the size of the Little Brown Crane, *Grus canadensis canadensis* (Linnaeus), with the long, slender legs characteristic of that bird. The species is named in honor of the collector Dr. G. L. Jepsen of Princeton University, well known for his work in vertebrate paleontology.

DIATRYMIFORMES

The lower end of a metatarsus, cat. no. 13258, collected in 1928 in the Lower Eocene of the Sand Coulee Beds, Sand Coulee Basin, Parly County, Wyoming, at "Camp 1," is in such condition of preservation that its definite identification is not considered practicable. The bone in question is similar in size to that of the small Darwin's Rhea, *Pterocnemia pennata*. It is much eroded and worn; judging from its porous appearance it apparently came from a young individual in which the bone had not yet been fully formed. The lower end of the shaft is flattened and compressed, with the lateral trochleae flaring rather widely. The ends of the trochleae are more or less rounded, but the characteristic grooves and processes of this part of the skeleton are missing, possibly not having been fully ossified before the death of the animal. The position of the trochleae in relation to one another is suggestive of what is seen in *Diatryma steini*, and the specimen is considered to belong in the Diatrymiformes. The individual is smaller than any described species in the order, being approximately one-half the size of *Omorhamphus storchi* Sinclair.

EGG SHELL FRAGMENTS

During their several seasons' work in the Eocene deposits of Wyoming, Dr. Jepsen and his associates have obtained five lots of ancient egg shell in more or less fragmentary condition. The material is well fossilized and presents the characteristic appearance of egg shell.

Whether this material is avian or reptilian it is not practicable to say. Dr. V. Van Straelen, who has devoted careful study to fossilized eggs, has indicated that without accompanying skeletons or other evidence it is not practicable to distinguish between eggs of the two groups under discussion when in a state of fossilization. (See Van Straelen, V., Les oeufs de Reptiles fossiles. Palaeobiologica, Bd. 1, 1928, pp. 295-305.) Brief notes on the material under examination may be of interest.

The first lot was collected by Dr. Jepsen on August 8, 1927, in the Lower Eocene of the Grey Bull formation between two and two and one-half miles southwest of Wardell's Ranch, on the south side of Dorsey Creek, Bighorn Basin, Wyoming. The material consists of a number of shell fragments, irregularly broken, dull grayish brown in color, and rather thin. The outer surface is smooth, with small irregularly placed pores. The shell averages .8 mm. in thickness. With this are two broken bits of bone, embedded in matrix, that are not identified.

Another lot was obtained in 1931 (field no. 178) in the Wind River Eocene of the red badlands west of Cottonwood Creek and north of Lost Cabin, Wyoming. The shell in these is much thicker, averaging 1.5 mm., and is light gray, more or less colored with reddish brown evidently from the matrix in which it was found. The shell is fine and somewhat rough without visible pores.

The third collection (field no. 197) comes from an area north of Wind River at the mouth of Dinwoodie Creek, and was taken in 1931. This also is from the Wind River Eocene. The shell is dull brown in color, somewhat roughened, with numerous depressed lines and evident pores, averaging 1.3 mm. in thickness.

A further set was obtained in 1931 (field no. 235) in the Wind River Eocene on Alkali Creek, five miles northwest of Arminto, Wyoming, in the *Lambdotherium* zone. These are a lighter brown than the last, with the shell fairly smooth with evident scattered pores, and averaging 1.5 mm. in thickness.

The last lot obtained in the Grey Bull formation, Lower Eocene of Dry Creek, north of Emblem, Bighorn Basin, Wyoming (no date of collection given), is similar to the first listed in color and in smooth texture, but has few pits evident under a low magnification. The shell fragments average .7 to .9 mm. in thickness. With them are a few fragments of small bones that are not identified.

It would appear that the five lots represent as many species falling into at least two groups, the first and last being contained in one, and the other three in another.

U. S. National Museum, Washington, D. C., December 5, 1932.

FROM FIELD AND STUDY

Feeding Habits of the Lesser Scaup Duck.—About 3:30 in the afternoon of January 18, 1933, while riding up the Pungo River in a motor boat about a mile and a half from Belhaven, North Carolina, I noticed a flock of approximately 325 Lesser Scaups (*Nyroca affinis*). Inasmuch as I was searching for plant foods of waterfowl I started my boat in the direction of the birds with the view of collecting some of the aquatic vegetation on which I supposed they were feeding. Shortly I noticed that the flock, with the exception of three or four birds, had disappeared. Continued observation with the aid of field glasses revealed that the entire flock would dive almost in unison, except two to six birds that remained on the surface possibly to serve as sentinels. In diving they would usually leap forward, some of them almost out of the water, with wings closed and tail slightly spread out. The interval from the time the first individuals of the raft began to dive until they were all up again varied from one minute, fifteen seconds, to one minute, thirty-five seconds.

The majority of the flock were under the water approximately one minute, but the exact time the various individuals were submerged could not accurately be determined. The period spent above water between dives was just slightly longer than that under the water. This extremely long period of time spent under the water for the Lesser Scaup is undoubtedly unusual, as John C. Phillips in his "Natural History of the Ducks" (vol. 3, p. 279) writes: "I have no notes upon the maximum length of time under water, but doubt if it is much over 35 seconds." He reports that 50 to 60 seconds have been recorded for the Greater Scaup, but that from 15 to

30 seconds is the length of its ordinary dive (p. 259). In this connection he points out that the Lesser Scaup usually feeds in water from 3 to 8 feet deep and remains under from 20 to 25 seconds. When I approached too closely, I observed that the length of time spent in the water was slightly shortened while the time spent on the surface between dives was more than doubled.

When the birds flew, I went to the place where they had been feeding, but found no trace of plant material on the water, indicating that the birds were probably feeding on mollusks, which is a common practice. I was much surprised to find that I could not reach the bottom with a 15 foot pole, so I am certain that the birds were feeding in water more than 16 feet deep. This greater depth undoubtedly accounts for the unusually long period under the water and the long period on the surface between dives. When the birds were frightened, they flew some 300 yards up the river and again commenced feeding as before. The water here also was found to be more than 16 feet deep.

The united behavior of this flock showed up in marked contrast to that of a flock of 23 Horned Grebes (*Colymbus auritus*) that were observed near by. When the boat approached, the ducks gracefully flew off as a compact unit, while the grebes, which had been in an unusually compact formation, began diving, swimming and laboriously flapping off in different directions.—CLARENCE COTTAM, *U. S. Biological Survey, Washington, D. C., February 9, 1933.*

New Bird Records for California.—*Arquatella ptilocnemis couesi.* Aleutian Sandpiper. A male was taken on December 13, 1925, near the entrance to Humboldt Bay. It was in a large flock of Black Turnstones. I saw Aleutian Sandpipers every week-end from that date until March 6, 1926. I am positive nine wintered on the Bay. December 19, 1926, until January 8, 1927, there were only five birds in the flock of turnstones.

Icterus spurius. Orchard Oriole. A female was found dead near a railroad track in town, on October 6, 1932. It had struck overhead wires, as a few feathers were missing from the forehead; also the tail was missing. The night before, Eureka was treated to a real thunder-storm.

Loxia curvirostra sitkensis; *Loxia curvirostra bendirei.* A large flock of Crossbills was found in scrub pines about 1½ miles from Samoa Post Office, across Humboldt Bay from town. The flock was there January 21, February 4, and February 18, 1923. It seemed to be divided equally between the above two forms; a specimen of each race was collected on January 14.

Calcarius lapponicus alascensis. Alaska Longspur. A lone female was taken on October 23, 1925, on the ocean beach across the Bay from town.

Melospiza melodia caurina. Yakutat Song Sparrow. A male was taken on October 8, 1922, in town, a block from the water front. Another male, taken on October 11, 1931, was taken on the salt marsh at the lower end of town.

Geothlypis trichas sinuosa. Salt Marsh Yellow-throat. A male was taken on November 26, 1922. It was in a small willow patch nearly a mile from Samoa Post Office, across the Bay from town.

Penthestes gambeli abbreviatus. Short-tailed Mountain Chickadee. Two males were taken on December 6, 1924, in a small patch of mountain lilac within the town limits.

Specimens of the above birds were identified for me by Dr. J. Grinnell at the Museum of Vertebrate Zoology, University of California.—JOHN M. DAVIS, *Eureka, Humboldt County, California, March 14, 1933.*.

White-crowned Sparrows Banded in Coachella Valley, California.—The January issue of *The Condor* (p. 34) carried a list of *Zonotrichia leucophrys leucophrys* banded at the Michener station in Pasadena. Believing a supplementary list of those banded in Coachella Valley might also be of interest we submit the following records of this race banded at Coral Reef Ranch, Coachella, California.

Band number	Date of capture	Band number	Date of capture
A131765	April 8, 1930	B142950	March 7, 1931
A131779	May 3, 1930	B161986	September 29, 1931
B104700	September 29, 1930	C101641	December 16, 1932
C67267	January 16, 1931	C101663	December 27, 1932
A175090	February 23, 1931	H74647	January 10, 1933
C67294	February 23, 1931	C161501	January 18, 1933

Since preparing the above list we have added the following item to our records: White-crowned Sparrow no. 161501 banded on January 18, 1933, has repeated in our traps on the following dates: February 16, 1933; February 24, 1933; March 1, 1933. The six weeks covered by the dates suggest the possibility of this individual having been resident throughout the winter. In addition a number of the birds have been seen through field glasses at different times during the winter months at sufficiently close range to make identification reasonably certain.—MR. and MRS. BEN L. CLARY, *Coachella, California, March 15, 1933.*

Analysis of Some Trapping Statistics from Berkeley.—Although the writer started the banding of birds in the summer of 1923, he did not band any at his present location until the summer of 1926. The present banding station is located at the writer's home, which is just to the north of Berkeley, California, in what is known as Kensington Park.

In 1926 there were scattered houses in the neighborhood, and the only trees were large acacias planted along the streets. Weeds covered all of the vacant lots. Shrubbery was at once planted around the house, so that at present there is considerable cover for the birds. Cats, dogs and hawks are quite common, although efforts are exercised to keep them away from the traps. Two Sharp-shinned Hawks have been shot on the traps during the past month, and another was seen flying past.

In spite of the adverse conditions which are present, records show the following numbers of birds banded since starting at this station: Last half of 1926, 355; 1927, 688; 1928, 560 (during this year the writer was away over a considerable period of time); 1929, 739; 1930, 626; 1931, 833; 1932, 786. It seems as though the planting of shrubbery, and the control of cats and other predatory animals, has apparently kept the bird population nearly the same as before the neighborhood was built up.

Crown sparrows (*Zonotrichia*) are the most abundant birds, among which are the Golden-crowned Sparrows (*Zonotrichia coronata*). The table given below is for the Golden-crowned Sparrow, and is an indication of the returns that can be expected from a group of ground-feeding migratory birds.

Winter	Banded	Returns First Year		Returns Second Year		Returns Third Year		Returns Fourth Year		Returns Fifth Year	
		No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
1926-27	213	35	16.4	18	8.5	7	3.3	4	1.9	3	1.4
1927-28	180	24	13.3	5	2.8	3	1.7	2	1.1	..	....
1928-29	146	17	11.7	2	1.4	3	2.1	..	....	..	....
1929-30	108	10	9.3	8	7.4	..	....	..	....	..	....
1930-31	60	7	11.7	....	....	..	....	..	....	..	....
1931-32	177	....	....	....	....	..	....	..	....	..	....

Much has been said relative to the turnover each year in a bird population due to natural and unnatural causes. The number of eggs laid by any species of bird is an index of the number that must be born each year to replace those that have died, in order that the bird population may be kept at a constant figure. If this balance in nature is decreased or is exceeded, then there is the danger of extinction, or the danger of an over-population of an area.

It is thought by the writer that another index may be obtained of this overturn in population by a survey of birds trapped, in a given locality, over a period of years. The proportion of adult birds to the total trapped, should give the proportion for that particular bird, that survives each year.

The following results are from the records of the writer, of birds banded in Berkeley, over a period from July 1, 1924, to June 30, 1932. The records used in the table are those of the Nuttall and Gambel sparrows (*Zonotrichia leucophrys nuttalli* and *Z. l. gambeli*), as the adults of these species are readily distinguished from the immature birds.

YEAR	1924-1925	1925-1926	1926-1927	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932	Total
Total number birds captured	104	72	415	599	599	557	497	465	3308
Adults captured	45	24	127	204	182	111	110	71	874
Percent of adults to total birds captured	43.2	33.3	30.6	34.0	30.4	19.9	22.1	15.3	26.4% (Average)

—ERNEST D. CLABAUGH, *44 Lenox Road, Berkeley, California, January 22, 1933.*

The White-tailed Kite at Benicia, California.—On February 6, 1933, a lad about seven years old told me that he had found "a dead hawk which was white with black on the wings" on a hill overlooking Suisun Bay at Benicia, California. I suspected from this description that the bird might be a kite, so I took the boy in my car to the place where he had left the bird. This proved to be in the rear of a house where there was an immature Red-tailed Hawk with a broken wing which was kept captive in a cage. Upon arrival at this location I found lying on top of the hawk's cage a White-tailed Kite (*Elanus leucurus majusculus*). The captive hawk was due for a rather rare meal, for it was intended that the kite be next on his menu.

Needless to say, I salvaged the kite, which was in fairly good condition. It appeared to have been shot with a rifle through the neck, probably on the previous day. It was a female; the length was 16½ inches and the wing spread 42 inches. The stomach contents were identified by Mr. Seth B. Benson of the Museum of Vertebrate Zoology at Berkeley, as five House Mice (*Mus musculus*). Four of these had been slightly digested and the other had probably been eaten on the day preceding that on which the bird was killed.

The marshes and fields about Suisun Bay are ideal foraging grounds for White-tailed Kites, and they are still occasionally seen, though one might search diligently for sight of one without success. Their nests have been found here in eucalyptus trees, or in oaks of the lightly wooded areas skirting the marshes.—EMERSON A. STONER, *Benicia, Solano County, California, March 14, 1933.*

On the Occurrence of Certain Hawks in Northwestern Montana.—Reference to Saunders' "Distributional List of the Birds of Montana" (Pacific Coast Avifauna, no. 14, 1921)—to which page citations given below refer—discloses a scarcity of published information concerning the hawks of the northwestern portion of this state. The following data which I have obtained in Lincoln and Flathead counties thus seem worthy of record.

Western Goshawk (*Astur atricapillus striatulus*). Saunders (p. 62) lists this form as a summer resident and probable rare winter visitor in the western half of the state. *A. a. atricapillus* is given as a fall migrant in the eastern part of the state, with one record of occurrence in winter cited. According to the latest A. O. U. Check-list (p. 64), Montana is not included in the breeding range of either subspecies, while all winter visitors would seem referable to *atricapillus*. I do not know which form occurs in Lincoln and northern Flathead counties. I do know, however, that goshawks occur here sparingly at all times of the year; that nesting occurs; and that the birds appear to be fully as common in winter as in summer. During the six years, 1927 to 1932, of my residence in Lincoln County at all seasons, I chanced to observe goshawks on twenty-nine occasions. These occasions are distributed among the months, January to December, respectively, as follows: 4, 1, 1, 2, 2, 1, 1, 7, 0, 2, 5, and 3. Two young birds on the wing were seen, August 8 and 25, 1922, in Canadian zone mountains near Fortine.

Cooper Hawk (*Accipiter cooperi*). A Cooper Hawk was seen near Fortine on December 5, 1928. This appears to be the first Montana record of the occurrence of this species in winter.

American Rough-legged Hawk (*Buteo lagopus s. johannis*). The A. O. U. Check-list (p. 69) describes the breeding range of this species as extending south to "northern Alberta, north shore of the Gulf of St. Lawrence, and Newfoundland." Saunders (p. 63) cites a number of summer records from Montana, with the statement that it "possibly breeds, or formerly did so." In Lincoln and Flathead counties, this species occurs regularly in summer, but more sparingly than in winter. It is rather rare at all seasons. During summer I have noted it near Fortine on the following dates: July 29 and August 8, 1922; August 23, 1923; May 1, 2, 3, and 4, 1927; August 8, 1931. In the mountains of southwestern Lincoln County, it was observed June 10, 1923; July 19 and August 4, 5, 7, 8 and 26, 1924. On August 8, 1922, two young birds on the wing were seen in a Canadian zone forest in the mountains of northern Flathead County.

Ferruginous Rough-leg (*Buteo regalis*). This species occurs as a rare migrant or straggler in the vicinity of Fortine. Single birds were observed on the following

dates: July 27 and September 4, 1921; April 20 and October 4, 1927; April 17 and 25, 1928.

Gyrfalcon (*Falco rusticolus* ssp.). A gyrfalcon with almost entirely white plumage, suggesting *candicans*, was observed near Fortine on December 9 and 10, 1927. At dawn on January 20, 1930, a large raptorial bird believed to be a gyrfalcon attacked a small flock of Mallards that had spent the night in a spring-fed pond a quarter of a mile from my home. Passing over me at such extreme speed that the whistling of its wings became almost a scream, the falcon hurtled itself downward toward the pond as the frightened ducks arose in great confusion. The distance and the lingering darkness together prevented me from ascertaining the outcome of the early morning raid. Similar raids had been heard just before daylight on at least two mornings during the previous winter, but the dates had not been recorded, the identity of the bird being unknown. The performance was repeated shortly after daylight on the morning of December 17, 1931, by a large gray or white falcon that certainly resembled a gyrfalcon more than it did a Duck Hawk.

Duck Hawk (*Falco peregrinus anatum*). Saunders (p. 65) states that this species has been recorded west of the divide in Montana only from Deer Lodge and Silver Bow counties. In Lincoln County I have noted it rarely in spring, summer, and fall. Specific dates are as follows: September 3, 5, 12 and 15, 1922; August 25, 1923; April 17, 1927; March 29 and 31, 1928; August 5, 1929; July 21, 1930; September 30, 1931.

Pigeon Hawk (*Falco columbarius* ssp.). It appears that pigeon hawks, of whatever subspecies, are rare birds in Montana. Saunders (p. 66) cites only three records for the occurrence of the species in this state since 1900. In Lincoln County I have observed pigeon hawks a number of times in recent years, but do not know whether they represented *richardsoni* or *bendirei*. My notes for 1921 include nine dates, but many of these are doubtful. Later dates are as follows: May 23 and July 16, 1922; July 17, 1924; May 18 (questionable) and August 14, 1927; April 3 and August 16, 1928; June 25, 1929; January 15 and October 2, 1931; March 19, August 2 and September 19, 1932.—WINTON WEYDEMEYER, *Fortine, Montana, February 9, 1933.*

Hermit Thrushes of the Northwestern States.—In our recent brief revision of the western Hermit Thrushes (McCabe and McCabe, Condor, XXXIV, 1932, pp. 26-40) the most acute deficiency of material was from Washington and Oregon and the northern part of the Great Basin. Through the kindness of Dr. Alden H. Miller a sufficient series from central and eastern Oregon and Washington and certain points in Idaho, collected by him and by Messrs. R. T. Orr and D. H. Blanchard in the early summer of 1932, is now available to indicate rather definitely the relationships of the three breeding races of this region. Certain information of a rather vague sort as to the birds of western Oregon and Washington has also become available in a recent publication by Oberholser (Scientific Publ., Cleveland Mus. Nat. Hist., 4, 1932, p. 8).

The accompanying map (fig. 23), which shows wing-lengths of male specimens (the most useful criterion in this difficult form) supplements our map of the western part of the continent, already published. It shows a prevalence of rather uniform races with abrupt transitions which accord well with geologic, climatic, or floral boundaries.

The characteristic Great Basin race, *polionota*, maintains its large size into central Idaho, there to break down rapidly to the dimensions of the unnamed race hitherto known principally from the interior of British Columbia, in correlation with the increasing rainfall, and changing timber. To the west, *polionota* undergoes like modification across the rather narrow divide between the Blue Mountains of central Oregon and the main ranges of the Cascades.

The race of the British Columbia interior is found to stream far southward into the United States, its dimensions hardly rising to those of *sequoiensis* until the Sierras replace the Cascades. It is an academic question, which can never be answered, whether these birds are genetically identical with the central British Columbia birds or merely represent an intergrading area between *polionota* and the small *slevini* of the coast. As has already been shown, about the head of the Sacramento Valley, *slevini* reaches well inland. Oberholser, in proposing the race *oromela* (male wing

82.7-92.5, av. 88.9 mm.) assigns to it in the main the northern range of *slevini*, but chooses his type far inland among the obviously sharply differentiated birds of the interior (Warner Valley, just outside the extreme northeastern corner of California). The type (August 28, no measurements) is far too late to be necessarily a locally breeding bird. If it represents the given maximum (92.5 mm. male wing) it is of the interior race, and occupies only an insignificant fraction of the area assigned to it by Oberholser. If it represents the average or minimum it is a synonym either of *slevini* or *nanus*. Certainly no birds which average 88.9 mm. male wing-length are characteristic of "central" Oregon or "central southern" British Columbia. Still less do 92.5 mm. birds occur in the great coastal range which is indicated.

Color, throughout the area under discussion, fluctuates faintly—too faintly to serve as a criterion of nameable races, and does *not* correlate with the fluctuations of size. The new series from Oregon and Idaho are the most neutrally grey groups we have seen.

The fine procession of increasing sizes from west to east is now complete, and we have in the United States four principal phases occupying narrow parallel bands or zones, accordant with topographic and climatic factors from the coast forests to the Rockies, with four successive and substantial steps in size which total, between *slevini* and *audubboni*, 21 per cent, accompanied by the slightest correlative changes in color, and none, that we can discover, in proportion. Only one of these, that of the Sierras and the Cascades, is divisible by a narrow margin into the northern and southern races.—THOMAS T. MCCABE and ELINOR B. MCCABE, *Museum of Vertebrate Zoology, Berkeley, January 26, 1933.*

Fig. 23. HERMIT THRUSHES OF THE NORTHWESTERN STATES. A. *Hylocichla guttata slevini*. B. *H. g. oromela* [?]. C. *H. g. polionota*. SINGLE FIGURES REPRESENT MEASUREMENTS OF SINGLE BIRDS (♂ WING LENGTH). MEASUREMENTS ACCOMPANIED BY FIGURES IN CIRCLES REPRESENT AVERAGES OF THE NUMBER OF BIRDS INDICATED.

The White-headed Woodpecker in Marin County, California.—On July 20, 1932, Mr. Frank Watson of St. Louis and the writer were investigating a large willow tree in which there was a small group of California Jays causing their usual commotion. Suddenly we were amazed to observe a White-headed Woodpecker (*Xenopicus albolarvatus*) slowly backing down the trunk of the tree. We were more surprised when the woodpecker, with a short flap of its wings, stationed itself underneath a large branch within five feet of us. At this moment we noticed that the pure white head lacked the red nape of the male, identifying it as an adult female. The bird then began to look over its observers without showing the least sign of suspicion or nervousness. After a moment it spread its wings and flew to a larger branch. As it flew it showed a white patch in the center of the wing. The bird was procured in order to establish the record and the specimen donated to the Museum of Vertebrate Zoology where it is now no. 62790.

The place of observation was in a small valley about three miles north of Point Bonita, Marin County, California. The surrounding country consists of many hills and valleys. The hills are covered with dense scrub thickets and the only trees are oaks. The valleys, with small willow-bordered creeks, are mostly pasture land and are at sea level.

This is the first record of the White-headed Woodpecker in any of the nine counties of the San Francisco Bay region. There is no reason to believe that the woodpecker was nesting in the vicinity.—DAVID DUNCAN III, *Sausalito, California, February 1, 1933.*

Triple Testes in a Snowy Plover.—Through the courtesy of Dr. Louis B. Bishop of New Haven, Connecticut, the writer has had the privilege of studying what, on gross examination, was apparently a case of supernumerary testis in a plover. Dr. Bishop furnishes the following record: "The bird was *Charadrius nivosus* (Snowy Plover), known as *Aegialitis nivosus* when I collected it, and was collected by me at the mouth of the Carmel River, Monterey Co., California, on July 20, 1920; 33499 is the number of the specimen in my collection, and in my catalogue I noted under it, 'three testes, one on the right and two on the left.'"

An examination of the specimen showed three ovoid bodies of about equal size, 5 millimeters in length and 2.5 in breadth. Two of these bodies were bilaterally situated at the same level near the medial edges of the kidneys, with their long axes directed downward and laterally. The supernumerary body was above the left testis but nearer the median line, with its long axis nearly vertical and its lower pole touching the lower testes. Microscopic examination of sections of all three bodies showed the usual structure of the testes, an apparently normal process of spermatogenesis and fully formed spermatozoa, indicating that the testes were all functional.

Supernumerary testes in birds must be of rare occurrence, although, of course, it is possible that many cases may have been observed but not reported. Certain it is that a search of the literature fails to yield any examples.

In a personal communication Dr. Oscar Riddle of the Carnegie Institution of Washington says that "ten to twenty-five instances of accessory testes have been observed by him in the examination of about 7500 male doves and pigeons, and that while probably none of these accessory testes were sectioned such structures are ordinarily so definite in the dove and pigeon freshly killed as to leave no doubt as to their character."

On the contrary, Dr. Ernst Mayr of the American Museum of Natural History of New York, in a personal communication says, "I have gone through all the available literature and have asked my colleagues but could not find any information about supernumerary testes in birds. I might add that I have sexed personally about three thousand male birds without ever finding a trace of a third testis."

It is clear that a third testis in birds is at least uncommon and it is possible that it is more frequent in some species than in others. It is certain, however, that the Snowy Plover examined possessed three functioning testes.—H. B. FERRIS, *Yale University School of Medicine, New Haven, Connecticut, February 24, 1933.*

Summer Birds of a Northern Arizona Marsh.—Through the kindness of Mr. Randolph Jenks and the Museum of Northern Arizona, I had an opportunity to study the birds of Rogers Lake on the last three days of June, 1932. This lake, 7½ miles west-southwest of Flagstaff, Coconino County, Arizona, is at an elevation of 7244 feet; it is two miles long by 1¼ miles wide, the long axis running from southeast to northwest. The greatest depth, however, is probably less than three feet. It is thickly overgrown with various aquatic plants and apparently occupies a very old crater. Western yellow pine is the common tree on the banks, and a small hummock on the northwestern shore supports a few gooseberries and two species of cactus—one a small *Opuntia*. Showers hindered progress daily, but only the southwestern third of the lake and the easternmost corner remained unexplored.

A colony of Eared Grebes (*Colymbus nigricollis californicus*) was discovered on June 28 in the south-central part of the lake. This was probably the colony Mearns recorded over forty years ago from "a lake near Flagstaff." On the 29th a census was taken. There were about 29 empty nests in various stages of dilapidation and 151 others with contents as follows:

1 young bird	1	2 eggs	70
1 egg	15	3 eggs	63
1 young, 1 egg	1	4 eggs	1

These grebes were not all laying, as hatching eggs and downy young were frequently seen. The crows nearby were innocent, for (1) they were never seen near the colony, (2) they would have left traces of depredations on such frail structures, and (3) they would have taken all the eggs. Several nests with two or less eggs had bits of broken shell. One egg with a fully grown embryo was floating near the edge of the colony.

I am indebted to Messrs. Barney M. Reid and Edward T. Nichols for their help in the census.

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Fig. 24. NEST OF EARED GREBE.
Fig. 25. NEST OF AMERICAN COOT.
Photographed by Barney M. Reid.

Numbers of ducks were seen daily; on the 29th I counted 11 Common Mallard (*Anas platyrhynchos*), 70 Pintail (*Dafila acuta*), 5 Blue-winged Teal, (*Querquedula discors*), and 4 Cinnamon Teal (*Querquedula cyanoptera*). Drakes were decidedly in the minority. A female Pintail was seen with a brood of six or more downy young in the northern corner of the lake. Late in the afternoon of June 30 an Osprey (*Pandion haliaëtus carolinensis*) flew in from the west, circled low, and departed northward.

Seventy-five or more American Coots (*Fulica americana*) were glimpsed among the sedges, and their nests were scattered over most of the lake. About 49 empty and unfinished nests were found, and 26 others as follows:

1 egg	1	7 eggs	7
1 hatching egg, 2 young	1	8 eggs	1
2 eggs, 1 young	1	9 eggs	3
4 eggs	1	10 eggs	2
5 eggs	2	11 eggs	1
4 eggs, 2 young	2	14 eggs	1
6 eggs	2		

One nest, with five young scattered about, two eggs in the nest (one just hatching), and one sunken egg in the water below was encountered.—ALLAN R. PHILLIPS, *Cornell University, Ithaca, New York, February 9, 1933.*

Further Occurrence of Sporadic Visitors in Southern California.—During the fall and winter of 1932, three birds worthy of record were brought in by friends or staff members of the San Diego Natural History Museum and prepared by the writer of this note.

Piranga rubra rubra. Summer Tanager. Female shot by J. W. Sefton, Jr., on September 19, 1932. The bird was found early in the morning in his garden on Point

Loma, within the city limits of San Diego. It is in the peculiar reddish plumage, not unlike the specimen recorded by the writer as *P. hepatica oreophasma* (Condor, XXIX, 1927, p. 154) and later identified as *P. rubra rubra* by Grinnell (Univ. Calif. Publ. Zool., 32, 1928, p. 187). This marks the fourth recorded occurrence of *P. r. rubra* for southern California, all within the last twelve years. Miller (Condor, XXI, 1919, p. 129; *id.*, XXXIV, 1932, pp. 48-49) records two taken and one seen in the vicinity of Los Angeles. One of these was a spring record and the others fall. The present bird adds another as a fall wanderer. It is interesting to note further that the three recorded captures of this bird in Lower California are of fall specimens and all from the northern district.

Buteo albonotatus. Zone-tailed Hawk. *An immature female with a poly-banded tail killed by Nat Rogan on October 10, 1932.* The bird, perching on a telephone pole, was shot with a 410 gauge shotgun from an upstairs window at Mr. Rogan's home in Chula Vista, San Diego County. He said it was quite tame and had been about the premises for several days. He also stated that it seemed to prefer this particular pole for a perch and, because of its close proximity to the house, an exceptionally good view was possible. On foggy mornings, Rogan said, the hawk would raise its neck feathers, showing the white under-down and giving a white-headed appearance. *Indeed he was much surprised to find the bird black-headed when collected. In a period of seventy years there have been four fall records of this species and one early spring record, all from San Diego County.*

Hydranassa tricolor ruficollis. Louisiana Heron. A female in first year plumage shot by F. F. Gander of the Museum staff December 20, 1932. The bird was found in an estuary of San Diego Bay, near National City, California. Another heron of this species was seen during the last week of January, 1933, by Lester W. Smith, custodian of Stone Bird Sanctuary at Babson Park, Massachusetts, who was a visitor in San Diego. This bird was in company with a single American Egret resting at high tide amid a large flock of shore birds on a sandy point on the south side of Mission Bay near Ocean Beach, San Diego. It was scrutinized at close range with high-power binoculars and Mr. Smith later checked the bird's identity by comparing specimens in the Museum collections. Four California records of this heron have now been made during the past nineteen years. All three of the collected specimens are at the San Diego Natural History Museum and are of either late winter or early spring record.—LAURENCE M. HUEY, *San Diego Society of Natural History, Balboa Park, San Diego, California, March 2, 1933.*

Nesting of the Say Phoebe in San Bernardino Valley, California.—My note in the *Condor* (XXXIII, 1931, p. 216) concerning the use of an active gasoline shovel as a nesting site by a pair of Ash-throated Flycatchers has excited some interest. It was expected this pair would return in 1932. We were disappointed in not seeing these flycatchers again, but were very much surprised to have a Say Phoebe (*Sayornis saya*) build a nest on a beam in the cab of the shovel.

The phoebe was observed around the shovel (near Colton, California) when it was in operation, but most of the actual nest building was done during several days when the shovel was not being used. The four eggs were deposited from day to day, probably during the night when the shovel was idle, up to April 25 (1932). The nest was but a few feet from the head of the shovel operator. The bird would not remain on the nest while the operator was at his post, but would go to the nest as soon as he shut off the engine and retreated ten or twenty feet, which he did at every opportunity. The excitement proved to be too great a strain for the phoebe and on May 23 I collected the cold eggs from the deserted nest. Incubation had progressed about one-third in each egg.

The site for this nest is not only unusual but the case furnishes the first breeding record of the Say Phoebe that I have for San Bernardino Valley where I have been an observer for over forty years. I have observed nests in the hills twenty miles farther south, between Corona and Elsinore, Riverside County. The birds are common visitors in the San Bernardino Valley in the winter months and breed commonly on both the Mohave and Colorado deserts.—WILSON C. HANNA, *Colton, California, February 22, 1933.*

EDITORIAL NOTES AND NEWS

In looking back over the 1932 volume of The Condor, with the point in view of singling out the most important new ornithological fact recorded therein during that year, we might perhaps be correct in selecting the Micheners' determination that, in the California Linnet, there may be as many as eight successive replacements of

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Figs. 26, 27. THE DIVISIONAL PRESIDENTS OF THE COOPER ORNITHOLOGICAL CLUB: AT LEFT, JOHN MCB. ROBERTSON, SOUTHERN DIVISION; AT RIGHT, GAYLE B. PICKWELL, NORTHERN DIVISION.

feathers, induced by plucking, between the regular times of annual molt.

The latest word from our World-travelling Cooper Club representative, Dr. Casey Wood, is that he is staying at the Suisse Hotel, in Kandy, Ceylon—will be there till August. He encloses a locally published plea for the "Protection of Wild Life in Ceylon," by Mr. W. W. A. Phillips. Such expressions as "Public interest more important than any ordinance" lead us to infer that the problems of conservation are pretty much the same the World over.

The West Coast School of Nature Study has announced that its Outdoor School is to be held this year June 18 to 28 in the Sequoia National Park. The staff of teachers includes, from membership of the Cooper Ornithological Club, Dr. Gayle B. Pickwell and Miss Emily Smith. Information may be obtained by enquiry of the former at State Teachers College, San Jose, California.

Volume II, part III, of LaTouche's "Hand-Book of Birds of Eastern China" has appeared. This work, published by Taylor and Francis, London, is thus in no appreciable way delayed by World conditions. The original high standard of usefulness is being held to; indeed, we find it the most helpful work at hand for identifying birds of the Orient.

Dr. Witmer Stone, Editor *The Auk*, has been elected an Honorary Member of the British Ornithologists' Union. This distinction is one that is rarely conferred. The only living Americans now so listed, besides Dr. Stone, are Frank M. Chapman, Harry C. Oberholser, and Leonhard Stejneger.

The article entitled "Second Annual Black Brant Census in California" in *California Fish and Game* (vol. 18, October, 1932 [issued March, 1933]) constitutes probably the most valuable single

contribution to exact knowledge of California's waterfowl that has appeared in any recent year. The author, Mr. James Moffitt, has been conducting, with the help of several other experienced Cooper Club members (C. I. Clay, J. M. Linsdale, T. T. McCabe, L. M. Huey), simultaneous counts of Black Brant on the several bays resorted to by this species along the California coast. In 1932, February 10-12, on Humboldt, Bodega, Tomales, Drakes, Morro, Mission and San Diego bays, a total figure of 43,946 individual birds resulted. In the article cited, Moffitt discusses informatively the facts and factors having to do with the present status and the future maintenance of the population of this important game bird. It is proposed to make the census-taking of this species, at the time of its northward movement, an annual event.

The April *Auk* contains an article by Emerson A. Stoner on the way to gather and store "A Collection Showing Food Eaten by Birds" (Vol. L, 1933, pp. 187-189, pl. VIII). Dried and cleaned crop or stomach contents of birds are kept in cotton-lined, glass-covered, individual insect boxes, suitably spread out and labeled, and constitute a permanent and interesting exhibit. No killing of birds need be done specifically for this purpose. "What specimens I have," says Mr. Stoner, "are the result of investigations made upon birds found already dead," such as those found traffic-killed on highways, ones killed by overhead wires, and some left hanging on fences by irresponsible hunters.

The United States National Park Service has started a new series of publications under the title "Fauna Series." Number 1 is an account of the "Fauna of the National Parks of the United States" (small octavo [150 x 230 mm.] pp. iv + 157, 56 halftone figs. in text, 1933—our copy received March 15). The authors are George M. Wright, Joseph S. Dixon and Ben H. Thompson, all members of the newly instituted Wild Life Division of the National Park Service, of which Division Mr. Wright is Chief. All these developments are the result of the increasing recognition being given to the importance of animal life, and of the maintenance of it in undisturbed estate, within the boundaries of all our Parks. Discussion of principles and of methods for insuring the realization of this ideal, in the face of various adverse human factors, constitutes the theme of this contribution. We cannot here quote, as we would like, extensively from the final formulation of policies (pp. 147-148). The whole thing is stated concisely, with supporting reasons, and we simply urge its careful reading upon naturalists generally. This valuable brochure, illustrated with the fine photographs by Mr. Dixon, of birds, mammals and characteristic landscapes, can be had for 20 cents from the Superintendent of Documents, Washington, D. C. A piece of work of such high standards is greatly to the credit of the administrative group within which it originated. High types of public administrators are exemplified in such men as the late Stephen T. Mather, the present Director of National Parks, Horace M. Albright, Assistant Director Harold C. Bryant, and the Chief of the Wild Life Division. The present contribution is a manual of practical animal conservation, the very best we have yet seen, in that the tenets set forth appear not to have been swayed in the least by any special interests seeking "utilization" of one or another element in the fauna. It deserves careful study by everyone interested in saving for the future as much as possible of the wild life in uncultivated areas generally, outside as well as inside National Parks. For nearly all the ideas set forth can and should be adopted widely, to the greatest benefit of present and future human culture.—J. G.

PUBLICATIONS REVIEWED

AN ATLAS OF EUROPEAN BIRD MIGRATION (Schüz, Dr. Ernst, und Weigold, Dr. Hugo. Atlas des Vogelzugs nach den Beringungsergebnissen bei palaearktischen Vögeln, etc. Kommissions-Verlag: R. Friedländer und Sohn, Berlin, 1931. [One portfolio]. Inhalt I Heft Text und 150 Tafeln. [Tafeln=150 map plates, 270 × 310 mm.]. Text mit 5 Abbildungen, pp. vii + 160. 96 RM.).—It is not too much to say that the publication under review places the study of migration on a truly scientific basis. Having made such a statement I hasten to admit that one range, usually the northern, has been delimited for many migrants, flight lines shadowed forth, and the other range indicated, as a rule with much less certainty. Bird banders are perhaps apt to overlook the storehouse of information which is the check-list, and regard their returns as discoveries of what was in fact perfectly well-

known before. Furthermore, marking individual birds is not a new practice, and many publications have been based upon it. But science must depend upon exact data in sufficient quantity to approach mathematical proof, and no body of such data of comparable scope ever existed.

The publication is a portfolio of 150 maps accompanied by a 160 page volume. The maps show all returns of much significance of European birds, related to their points of capture by systems of lines and conventional signs which convey graphically a surprising number of essential facts in regard to age, interval and date at both ends of the record. In some cases, where the information is slight, two or more maps are printed on one plate. In others, when data are abundant, several or many plates are devoted to one bird (11 in the case of the Starling and 21 in the case of the Black-headed Gull) with certain summarizing maps in addition. Smaller inset maps are used to show distant returns, as from Africa, or, more frequently, to show the "Lebensraum," which we may translate awkwardly as "population range," a new departure of great importance. The accompanying volume gives the known ranges of the birds, usually from Hartert for Europe and from Grote for Africa, information and references for the banding, and excellent bibliographies arranged both under authors and localities, and sometimes, in cases of very crowded maps, certain data on ages and dates which cannot be expressed graphically for lack of room.

The maps include a total of 152 species and subspecies and some 69 more are briefly discussed in the book. Of the forms mapped some 9 are primitive aquatic forms; 19 wildfowl; 19 raptors; 26 rails, shorebirds, and snipe; 11 gulls and terns; 3 auks and murres; 5 columbine; 2 owls; and most of the rest passerine.

Of the marine birds a large number are of course banded as nestlings, but it is surprising to find how many song birds also are banded before July of their first year, a condition which indicates less emphasis upon trapping than exists in our American technique. Needless to say such banding, especially for the study of migration, is by far the most valuable. Nothing is more discouraging than poring over pages of return records of trapped migrants, of which we know neither whence they come nor whither they go, in order to find one or two significant records, of known origin and known wintering place. The comparative futility of a great deal of our banding has been shown by the sudden demand for exact information on the summer and winter populations of the many species of wildfowl which human slaughter, aided by disease, drainage and drouth, is bringing post-haste to their end. Even before 1926 immense numbers of ducks had been banded, and the number since is legion; but so many are both banded and shot in the fall that the merest handful of significant facts are to be had from thousands of returns. This is no one's fault. Almost any return has some value, and the situation merely reflects the fact that ornithology, like other arts and sciences, clings to the population centers of occidental civilization, which are small spots on a narrow latitudinal belt, while banding, to produce the best results, needs a north-south distribution of effort.

This is no less true in the Old World than in the New. Travel south from London as far as from the Great Lakes to New Orleans and you are in the Sahara. Add the distance to Mexico City and you are in the heart of Africa. The wintering populations are harder problems than our own. Active banding clusters in a small radius about the North Sea and the Baltic, and lacks the far-flung organization which we here have, from the Atlantic to the Pacific, from Canada to the Gulf.

It is not by merely satisfying our desire to reduce nature to a formula and plot it on a map that the conception of the *Lebensraum*, here for the first time a concrete and measurable actuality, owes its importance. Isolation is the key word of most modern theories of racial differentiation, and in the case of vertebrates this usually means geographic isolation. Ornithology emphasizes this isolation almost entirely in terms of the breeding range; and the integrity of the breeding population, upon which the whole concept of the geographic race is based, remains to be demonstrated among birds.

In so far as the isolation of mutational characters is concerned, breeding isolation is naturally the only one of importance. It is further true that even in regard to direct or selective environmental influences, the breeding period is that of danger and susceptibility—of development, stress, and sharp proof of the power to survive. Yet so far as environment may constitute an effective agency, the case for such emphasis on the breeding range, especially

when from two-thirds to three-quarters of the year is spent elsewhere, is not convincing. It is probably not too much to predict that if environment and variation can ever be effectively correlated in birds, the year-round environment will have been taken into account, as with other organisms. Granted that races must be distinguishable and their ranges delimitable without the aid of any marking system, none the less knowledge of the manner in which the *indistinguishable* component fractions of races or undivided species are isolated, or are likely to have been isolated before differentiation—of the nature of the units from which we must believe races to have sprung—must be of great importance to the theory of geographic differentiation among birds. Such facts, reasonably self-evident for most land vertebrates, require proof among creatures of unlimited mobility. To become conscious of such a problem and to take long steps toward solving it in some cases, marks an important point of progress.

It is an extraordinary fact that under present world conditions Germany can issue such a piece of work (assistance was received from the Prussian Ministry of Science, Art, and Public Instruction) in so sumptuous a style, while the results of American banding, increasing at such a rate as soon to be beyond hope of reduction and organization in usable form, continue to accumulate, of little use to anyone who cannot go to Washington and work there at length.

Dr. Schüz is stationed at the Rossitten bird observatory of the Kaiser Wilhelm Association for the Advancement of Science. Dr. Weigold is director of the Natural History Museum at Hannover, and has spent much time at the Helgoland bird observatory. Both have published many papers on similar subjects. Dr. Schüz's *Ergebnisse der Vogelberingung* in the Proceedings of the VII International Ornithological Congress is the best general commentary on the contents of the present publication.—T. T. McCabe.

The Birds of France (Les Oiseaux de France, Par A. Menegaux. Volume I. Introduction à l'Etude de l'Ornithologie Rapaces, Gallinaces, Colombins, Piciformes. Paul Lechevalier, Paris, 1932).—This book, volume XXVI of the Encyclopedie Pratique du Naturaliste, is the first of three in process of preparation upon the birds of France. A short introduction explains rules of zoological nomenclature, and discusses briefly general distribution of birds over the surface of the globe (with map). The first part contains chapters upon the topography and anatomy of birds; eggs, nests and incubation; migration; longevity; manner of collecting and preserving skins and eggs; and insect parasites of living birds.

The second portion of the book contains classification of the four included groups: birds of prey; gallinaceous birds; pigeons and doves; woodpeckers. When subspecific names are reached in the keys the reader is referred by plate numbers to the "atlas," which constitutes the third portion of the book. Here each of the included sixty-four representatives of the avian fauna of France is given one page of descriptive information, accompanied by a full-page colored portrait. Method of treatment is the same for all: scientific name, common names (French, German, English, Italian, Spanish); color description; measurements; habits and habitat; geographic distribution. The volume ends with: list of black-and-white figures (appearing throughout the text); list of colored plates; table of contents; alphabetical index of all names used.

The author has thus gathered together under one cover a useful handbook of general information upon birds for the purpose of aiding both French bird students and foreign visitors more readily to become acquainted with the avifauna of France. As stated in the preface, of the volumes to complete the series the next will deal with water birds, the third with passerine birds. This last volume will include chapters on usefulness of birds and on the protection of birds.—Margaret W. Wythe.

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

January.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on January 26, 1933, at 8:00 p. m. in Room 2003, Life Sciences Building, Berkeley, with about seventy-five members and guests in attendance. In the absence of officers Mr. Alden Miller presided. Minutes of the Northern Division for December were read and approved. Minutes of the Southern Division for December were read. Proposals of names for membership were as follows:

William H. Behle, International House, Berkeley, Calif., by Margaret W. Wythe; Miss Elizabeth L. Curtis, 5648 Beach Drive, Seattle, Washington, Edwin D. McKee, Grand Canyon National Park, Grand Canyon, Arizona, and Florence Ann Sumner, P. O. Box 739, Elk Grove, Calif., by E. L. Sumner, Sr., through Western Bird Banding Association; Hubert O. Jenkins, Sacramento Junior College, Sacramento, Calif., by J. Grinnell; Muriel Cunningham, 2259 Cedar St., Berkeley, Calif., H. Beverley Fisher, 811 Shattuck Ave., Berkeley, Calif., Mrs. Vivian P. Smith, 2285 Cedar St., Berkeley, Calif., and Mrs. Inez D. Troxell, 636 Coventry Rd., Berkeley, Calif., all by Jean M. Linsdale.

Mr. J. Grinnell, chairman of the nominations committee appointed to propose officers for 1933 presented the following names: for president, Gayle B. Pickwell; vice-president, Alden H. Miller; secretary, Mrs. Joseph Grinnell. Mrs. Allen moved that the secretary be instructed to cast a ballot electing the above named to office. The motion was duly seconded and carried and the vote cast accordingly.

Mr. Grinnell brought to attention the very useful pocket list of "Birds of Lake Merritt and Lakeside Park" just issued by the Oakland Ornithological Club. This list may be obtained at 503 Plaza Bldg., Oakland, for the sum of five cents.

Mr. C. A. Bryant told of an outing on December 6 when under the guidance of Mr. Peyton he had the rare privilege of seeing six California Condors in Sespe Creek Cañon, Ventura County. Miss Rinehart told of the capture of a Mountain Bluebird recently by Mr. Brock at Sunol. Mr. Clabaugh asked whether anyone could report success with nesting boxes put up in this region. Mr. Cain replied that at the Scout Camp in Diamond Cañon titmouses, house wrens, flickers and a pair of red-breasted nuthatches had raised young in nest boxes, and screech owls had used the boxes as roosting places.

The evening's program was furnished by Mr. William H. Behle of Salt Lake City, who gave an illustrated talk upon "Bird Rookeries of the Islands of the Great Salt Lake." Mr. Behle's field work in this region had qualified him to make an excellent report upon the life histories of the birds of these rookeries which were first described by Captain Stansbury in 1849.

Adjourned.—HILDA W. GRINNELL, *Secretary.*

FEBRUARY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held in Room 2003, Life Sciences Building, Berkeley, on February 23, 1933, with President Pickwell in the Chair and about seventy-five members and guests present. Minutes of the Northern Division for January were read and approved. Applications presented at the January meeting of the Southern Division were read. Proposal of the name of Andrew G. Elder, Route 1, Bothell, Washington, for membership in the Club was made by E. L. Sumner, Sr., through the Western Bird-banding Association.

The following proposal for Honorary Membership was made: "We, the undersigned members of the Cooper Ornithological Club, propose for Honorary Membership in the Club, Arthur Cleveland Bent, of Taunton, Masschusetts. By favorable action on this proposal the Club will register its recognition of Mr. Bent's long period of active study in North American ornithology and especially its lasting appreciation of the resulting series of "Life Histories," already published through the ninth volume." Signed: Jean M. Linsdale, Joseph Grinnell, Alden H. Miller, T. T. McCabe. Dated February 21, 1933. The Chair remarked that following the provisions of the Constitution, no action would be taken upon this proposal until after its second reading.

Mr. Elmer Aldrich of the Oakland Ornithological Club announced that for the convenience of Cooper Club members wishing lists of the "Birds of Lake Merritt and Lakeside Park" he had brought copies with him for distribution.

Field notes were contributed as follows: On February 19, Mr. Bryant and companions saw a pair of White-tailed Kites near Greenbrae, Marin County, and later in the day thousands of Black Brant at Tomales Bay. On February 22 the same group saw a flock of fifteen Whistling Swans near Benicia. Mr. Harold W. Clark reported that during the Christmas holidays when on Pine Crest, 1800 feet elevation, on Howell Mountain he looked down upon a flock literally of thousands of robins, the sound of whose twitterings was all-pervading like the noise of falling waters. Miss Alice Baldwin reported that on the Stanford Campus on February 4, and again on the 7th of that month, she had seen paired Bush-tits leave the flock, evidently initiating the nesting cycle. Mrs. Kelly told of seeing a pair of Bush-tits in

Alameda actively engaged in nest-building on February 4. Miss Amy Rinehart told of seeing fourteen Red-breasted Mergansers near the head of San Leandro Bay recently. Mr. Jack Arnold reported having seen a flock of thirty-five or forty Lewis Woodpeckers near Orange Cove, Fresno County. Mr. Pickwell said that on August 15 an unfamiliar note caused him to look out into his garden in San Jose, whereupon he saw there a female Arizona Hooded Oriole in company with an immature bird of the same species. On August 17, Dr. Loye Miller saw what were doubtless the same birds in a near-by garden.

The evening's program was given by Mr. Walter W. Bennett of Sioux City, Iowa, who showed many beautifully colored slides of California and Nebraska birds, and also several motion picture films. Some of these latter were of nesting Yosemite birds and some were of birds of the sand-hill region of Nebraska. The films showing the nesting activities of the Long-billed Curlew and the Pied-billed Grebe were especially fine.

Adjourned.—HILDA W. GRINNELL, *Secretary.*

SOUTHERN DIVISION

JANUARY.—The regular monthy meeting of the Southern Division of the Cooper Ornithological Club was held at 8:00 p. m., Tuesday, January 31, 1933, at the Los Angeles Museum, Exposition Park, Los Angeles, with President Michener in the Chair and about forty-five members and guests present.

Minutes of the Southern Division for December were read and approved. Applications for membership were read as follows: Dr. A. J. Maskey, Jr., Flagstaff, Arizona, and D. E. McHenry, Grand Canyon, Arizona, proposed by Lyndon L. Hargrave; Joseph C. Dunlevy, 177 S. Commonwealth Ave., Los Angeles, California, proposed by Loye Miller.

Mr. George G. Cantwell, chairman of the nominating committee, reported its selection of officers for 1933 to be: President, John McB. Robertson; vice-president, R. B. Cowles; secretary, Mrs. J. Eugene Law. No other nominations being offered, it was moved and seconded that the nominations be closed and that the secretary be instructed to cast a unanimous ballot electing the above-named persons to office. This was done.

The speaker of the evening, Mr. M. P. Skinner, was introduced by President Robertson and gave a brief personal sketch of the life of W. Leon Dawson, followed by a series of lantern slides that were made from photographs used by Dawson in illustrating his book, "The Birds of California."

Adjourned.—LAURA B. LAW, *Secretary.*

FEBRUARY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at 8:00 p. m. on Tuesday, February 28, 1933, at the Los Angeles Museum, Exposition Park, Los Angeles, with President Robertson in the Chair and about seventy-five members and guests present.

Minutes of the Southern Division for January were read and approved. Applications for membership were read, as follows: Dr. Isabel McCracken, Box 1545, Stanford University, California, and Vernon L. Marsh, Box 597, Great Falls, Montana, both proposed by W. Lee Chambers.

The evening's program was furnished by Mr. C. A. Harwell, Park Naturalist, Yosemite National Park, who introduced his subject, "Yosemite Birds and their Songs," with a very interesting talk on the songs of birds, how to remember them, how to analyze them. Many excellent imitations of birds' calls and songs were given, and suggestions were proffered on how a whistler might arrive at the desired pitch of any song. Mr. Harwell further illustrated his talk with a series of lantern slides showing the Yosemite Park as a very beautiful habitat both for man and bird. The bird population of Yosemite was well pictured, and the slides depicting life history scenes of the Water Ouzel were exceedingly interesting. At the close of his talk, Mr. Harwell graciously responded to questions asked by interested members.

President Robertson announced that an eastern member of the Cooper Ornithological Club was present, and called on Dr. Louis Bishop to introduce Mr. R. Magoon Barnes, of Lacon, Illinois. Mr. Barnes, well known to many of the members present as proprietor of the magazine "The Oologist," spoke of his pleasure at meeting with the Southern Division again and of his regret at not seeing familiar faces he had known in past years. A brief sketch was given of his early contact with the bird men in California, and the Cooper Club was congratulated on the work it had done and the record it had made.

Adjourned.—LAURA B. LAW, *Secretary.*